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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

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GENERAL

NEW LEVEL OF COORDINATION

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 7, 8-21 Apr 86 pp 1, 3

[Two interviews under the "Address Key" rubric]

[Text] Resolutions of the 27th CPSU Congress mandate high-pace increase in the scale of application of modern computing equipment. In order to coordinate works on the development, manufacturing, application and servicing of computing equipment in the national economy, the USSR State Committee for Computing Equipment and Information Science has been created.

Heads of two "electronic centers", All-Union Scientific-Research Institute of Applied Automated Systems (VNIIPAS) of the USSR State Committee for Computing Equipment and Information Science and AN SSSR and All-Union Interindustrial Scientific-Research Center for Organization of Software Production and Application, the head organization of the State Fund of Algorithms and Programs (VMTs GosFAP), are talking about the work of these organizations.

VNII OF APPLIED AUTOMATED SYSTEMS
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Presentation by Director of the Institute, Doctor of Technical Sciences, Professor O.L. Smirnov [boldfaced are questions by A. Lepikhov, the interviewer]:

Since January, 1984, the Centralized System for Automated Mutual Information Exchange With Foreign Computer Networks and Data Banks (TsSAO) has been functioning in the industrial operation mode.

By means of communication lines, we are connected to respective organizations-partners in Bulgaria, Hungary, DDR, Cuba, Mongolia, Poland, CSSR. Similar systems for automated information exchange are being created in Vietnam and Romania. We are also connected to the largest automated data banks in a number of Western countries.

What are the advantages of this organizational form?

First of all the timeliness. The thing is, that new information in the latest issues of scientific magazines is at least six months, and sometimes even a year old. Let alone monographs, that are even further lagging the pace of today's scientific and technical progress. In our case, however, after being deposited into a data bank, information is immediately available to any researcher, whether he or she works in Moscow, Prague, Paris or New York.

Then it is the comprehensiveness of information coverage on any subject. A computer will not miss a single magazine or article, where the subject is mentioned.

Another advantage are unquestionable labor savings. Here is the simplest example. Nowadays, before starting the work on a scientific subject, scientists compile analytical surveys. This usually takes several months of hard work. In our case, it is just two to three hours of "talking" to a computer.

For automated information exchange between research organizations, a so-called "Akademset" has been created in our country. It includes institutes of Academy of Sciences USSR and of Academies of Sciences of Union Republics, as well as some institutes form various industry sectors.

In accordance with the adopted Complex Program for Scientific and Technical Progress of CEMA member countries, we are taking part in the development of the international information exchange system, which will facilitate information support of all research problems, included in this program.

How else can be your system helpful to a scientist?

It will save time, that is now spent for various conferences and symposiums, and improve the efficiency thereof.

It is not an exaggeration, that modern technology rerally revolutionizes this process. Scientists on different continents can now have a serious scientific conversation and even a sharp discussion by just performing simple manipulations at keyboards of their vodeoterminals or personal computers. They are being assisted in this by base computers, including the ones in our Institute. Hundreds of thousands of messages, coming simultaneously from a number of researchers, that are part of the so-called teleconferencing system, are stored in their memory. The text, transmitted by a user to another user or for everybody, who is interested in a given scientific problem, can be retrieved from computer memory at any convenient time. This is the principal difference between "teleconferences" and telephone ones, when all participants must be present at their machines at the same time. Besides, using a printer, one can have a complete record both of his or her own and of other people messages immediately after the teleconference has been completed, and any number of copies at that. Another advantage of "computerized contact" is that any diagrams and/or graphs can be displayed on a screen and then sent to colleagues for subsequent analysis. Here is but one example. The World teleconference on Bioconversion was successfully conducted from the VNII of

Applied Automated Systems terminals. The Soviet group included 12 persons, and the total number of participants was over 100 professionals from 16 countries. On the average, around 100 messages came per day, both "papers" and public commentaries to them.

These telereports were practically "momentary" publications, that were often created right in the course of the scientific discussion. They circled the planet, skipping the long way of preparing traditional articles.

I would like to add, that today a scientist can take part in any of more than 200 scientific teleconferences, that take place simultaneously and do not have breaks. The following is also important: the software of these telconferences is, as professionals call it, "extremely user friendly". In other words, in order to participate, one does not need any previous background, as the computer system "forgives" any errors and helps correct them, and as it has very concise, but at the same time extremely comprehensive commands.

It is very convenient for scientists, residing in different time zones, that they can connect to the teleconferencing system at any time. Say, we transmit our reports to American researchers, when they are asleep. In the morning they retrieve the reports from computer memory, start working with them, edit them and send them back to us. If required, one can always go back to any version of a future article or monograph, because they are also stored in computer memory. Using this method, we have long been writing joint research reports, for instance, we write international monographs together with Czhechoslovakian and Bulgarian scientists.

You and I live in Moscow. How can the automated information exchange system be helpful to residents of our capital?

I shall name but a few of a great number of applications. Our city is the largest cultural center i the country. Every night there are a great many of the most interesting events. I am not only talking of theaters and movies, but of a tremendous number of entertainments in clubhouses, creative Unions organizations, lectures in the system of party and political education. It is practically impossible to find out about all these events. At the same time, it is very easy, from a technical standpoint, to create a respective automated reference system.

Or, for instance, in rpinciple there is no problem to inform Muskovites and or guests of our capital on when, how much in in which stores certain goods will be sold.

The problems you are solving cannot but impress. But to solve them is probably not as simple, as it can seam to somebody, who is being told about things, that have already been done by employees of the Institute, is it?

One cannot complain about the lack of difficulties. First of all, we are limited in the number of employees, because there is not enough working area.

Another difficulty is that there are definitely not enough communication lines. And it is not that there are simply very few lines, but that there are

a large number of unsolved economical problems. If one seriously contemplates a sharp expansion of automated information exchange, one should drastically reduce fees for using assigned communication lines. Today we pay for them as much as for telephone calls, which is extremely expensive. And another one. Expenditures for paying for communication channels must be budgeted as expenditures, related to the production activity of the organization, that uses information.

Unfortunately, far from everybody understands the permanent value of computer-information networks.

[Picture by A. Tyagny-Ryadno]

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[Interview by Doctor of Technical Sciences, Professor L.Gorskiy, Director, VMTs GosFAP]

We pay great attention to developing software for personal computers (PEVM). The swift increase in production of computer of this type poses problems, that are far from simple. First of all, this is the ahead of time development of software therefor. Let me explain what I am talking about. Personal computers must reach the user (who is often, by the way, is not a professional programmer) with the necessary set of programs, the so-called "basic software". For large and medium computers this software has been developed over the years, but for personal computers this method is absolutely unacceptable. Basic software, that includes operating systems, translators from high-level languages, text and graphic editors, data base management systems and "electronic spreadsheet".

We are hopeful, that the creation of the new Committee will help solve these problems. Our professionals have developed a project for creating the Moscow Personal Computer Center. We hope, that similar centers in various cities of our country will make it possible to satisfy our demand for personal computer software.

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STATUS OF AUTOMATION IN BELORUSSIA REVIEWED

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 6, Jun 86 pp 4-5

[Article by I. Laurinavichyus: "Computers Today and Tomorrow"]

[Text] Today experts value information as a new resource of the nation comparable in its significance to such resources as food and energy. It is no accident that the "Main Directions of Economic and Social Development of the Nation for the Twelfth Five-Year Plan and for the Period up to the Year 2000" in the latest edition of the Party Program gives considerable attention to the information industry, which encompasses microelectronics, computer technology, instrument making and a number of other sectors.

Belorussia has been lucky enough to be in on the entire computer equipment production cycle -- from development to series manufacturing. All this promises appreciable gains for the national economy of the nation and the republic, a rapid increase in the efficiency of production. How are these capabilities to be used in the national economy of the BSSR? What is the outlook of such a program?

Automated Management Systems in Motor Transportation: Attainments and Outlook

It is not at all surprising that motor transport is where automated management systems are being most widely used in our republic today. After all, the immense volume of shipments -- and road vehicles today are carrying about four fifths of all freight and three fourths of the passenger cargos -- has a correspondingly immense volume of documentation without peers in other sectors: for every worker there are from seven to fifteen documents per month that need subsequent processing. It is the "Avtotranssistema" republic-wide technical production association that handles this processing.

The creation of a specialized information service in the structure of the ministry has improved the system for gathering, input and processing of information.

"We have been working for some time with such technical information media as punched cards, punched tape and magnetic tape," says L. A. Peker, general director of the association. "Things have now been put on a qualitatively new basis: each operator feeds information directly to the computer."

Installed in the computer room are more than a score of displays, each directly connected to the large computers of the association. The virtual (modularized) computers set up in this way allow better use of the storage of the main computers, as their computing capabilities are now at the service of all operators simultaneously, and what is most important, they allow higher-quality and more timely processing of the technical and economic information coming in from all motor vehicle enterprises of the republic and facilitate the necessary administrative decisions.

In addition to computational tasks using computers, it is the job of the "Avtotranssistema" Association to develop and introduce automated management systems in motor transportation, expand existing management systems, and also to keep the software and hardware of automated management systems operational. In a word, to computerize motor transportation.

"Of course it's a good thing that we have already got away from the old-fashioned methods of gathering and preparing information," continues Leonid Arkadyevich. "The bad news is that there is still a lot of manual labor involved."

This failing has been successfully overcome in automated systems for management of technological processes of freight and passenger transportation. Here information is gathered automatically. For example, automated systems for controlling bus traffic on city routes (ASU "Interval") have been set up in Vitebsk and Mogilev. Thanks to transceivers installed on every bus, the dispatcher has the opportunity to keep all of them on schedule at all times -- both via radio communication channels, and by means of special information boards installed at bus stops.

A similar system -- ASU "Mezhgorod" -- has been set up and put into operation for intercity freight shipments. The orders of all six thousand customers that have been computer-processed are then sent out as assignments both to individual drivers, and to whole truck fleets. The result is already apparent: the truck utilization factor has reached 96 percent. Over the past four years, the cost of trucking in the republic has fallen by 2.4 million rubles as a result of expenditures in management and improvement of transport work.

L. A. Peker sums it up: "In a word, the efficacy of the automated management system is optimistically attuned. However, we have a long way to go before the sector is totally computerized. As of now, there is considerable loss because of our inability to process information on the spot, directly in the truck fleets. This requires two conditions: first, we need to solve the problem of communication channels, and secondly, we are waiting for scientists to give us new and highly effective personal computers that can operate both independently and as modules of a mainframe computer located here at the 'heart' of the motor transportation management system. Such a combination of capabilities of the peripheral equipment and the 'brain' of the system promises great advantages both in the immediacy and in the quality of management."

The Personal Computer: Who Needs it, and Why?

"Our institute," says G. P. Lopato, director of the "Order of the Red Banner of Labor" Scientific Research Institute of Computers, "over the twenty odd years of its existence has developed more than twenty models of computers of all generations, and several dozen types of peripherals, and has taken part in developing operating systems and software systems. We are now continuing our work on developing computers in the YeS program -- the unified system of computers for socialist nations -- on developing new generations of computers, and also on the development of personal computers."

The personal computer is a machine of a new class that appreciably facilitates a person's work, freeing him from routine jobs, leaving for him only the work that no man-made machine can yet do -- conceptual thinking.

The demand for such machines in the national economy is in the millions. The time is not far off when every creatively employed person will be able to have this versatile tool at his own work station for handling information -- as a reference, as a notebook with a large volume of information.

"What can a personal computer do?" we asked Chief Model Designer, Candidate of Technical Sciences V. Ya. Pykhtin.

"The machine is designed for handling a wide range of tasks in management, statistics, economics, automation of engineering work, for organizing automated work stations of specialists in a variety of profiles. Computers are very simple to use. They can be operated even by people who are unfamiliar with the basics of computer technology. On the other hand, they have parameters that are commensurate with those of the bulky stationary systems of past generations. The use of professionally specialized modules and application-specific software systems will enhance the efficacy of computers when used in various configurations and in different professional systems. Our main goal right now is to give this model the performance parameters that will enable stable long-series production of the devices, and in this way ensure wide-scale use in our country."

From Local Systems to an Integrated System

Everything that we have talked about in the foregoing is of current interest to us, of course, not of itself, but in connection with the great economic and social problems whose solution is vital to the entire nation. It was this that we spoke of with N. M. Konopatskiy, chief of the department of computer technology of Gosplan BSSR.

"Nikolay Mikhaylovich, how typical is the example of the 'Avtotranssistema' technical production association for the use of computer technology in the republic?"

"The 'Avtotranssistema' association is now using progressive techniques. And it is likely that other automated management systems are based on these techniques. Motor transportation workers are doing start-to-finish automation tasks -- from the enterprise to the ministry level. They are using progressive approaches such

that the resultant conditions bring the automated management system right to the work station. And in fact, setting up automated work stations."

"This is very important, considering that computer technology at this time is generally being used in the area of management, and to a lesser extent -- directly in production."

"You are quite right. During the last Five-Year Plan it was basically systems of organizational and economic type that were being set up, i. e., systems primarily for the needs of planning and management. At the same time, the most effective areas such as automation of engineering work, the work of designers, technologists and researchers, did not get the development that they deserved. And the quotas for the Twelfth Five-Year Plan are the first to define them as 'main directions.'

"The new five-year plan proposes implementation of four such directions. The first is to set up automated systems for research planning. We are taking up the development of such systems in nearly every large design organization in every leading enterprise of the republic. Calculations show that by doing this we will be able within five years to lower production costs by 50 million rubles in machine building, electronics and instrument making, by 60 million rubles in construction, and to make about 10,000 people available for other work.

"A direction of equal importance is the development of automated systems for technological process control. Over the past ten years, only 79 such systems have appeared in the republic. During the Twelfth Five-Year Plan, at least 500 are to be set up.

"The third important direction is further development of organizational and economic management systems.

"In the Twelfth Five-Year Plan, scientists and production workers have started to get used to personal computers.

"Of course, we have continued our work on development of all the aforementioned systems, i. e., combining them into an integral unit. To do this, a network of computer centers is to be set up. In the first phase, we will unify 24 sector-wide automated management systems with intersectoral systems such as the ASPR [automated control system for planning calculations] of Gosplan BSSR, or the computer-aided information processing system for the Council of Ministers of the republic. This is also an ambitious and complex program that will enable us to solve many administrative problems."

"Is this, then, the prototype of the integrated system?"

"Actually, the way things stand right now, our problem is this: to accomplish large-scale automation, to unify all the aforementioned automated management systems -- computer-aided design systems, automated technological process control systems, and organizational-economic systems -- into integrated systems. These are systems of a very high level, and they will make their appearance in the Twelfth Five-Year Plan.

"And there is one more important point. Computer technology today is making inroads into every area of human endeavor. And therefore the all-encompassing task of the day is computerization, i. e., teaching everyone to master the computer. We must teach this to school children and students in advanced education. Within five years, our people will have to be up in computer technology. Naturally, this will be of assistance in more efficient use of computers. We intend to set up a large number of specialized classrooms in intermediate schools and intermediate vocational educational institutions in the system of the Ministry of Higher Learning of the Republic."

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CSO: 1863/330

SOFTWARE

SOFTWARE INDUSTRY: NEW SECTOR OF ECONOMY

Moscow PROBLEMY TEORII I PRAKTIKI UPRAVLENIYA in Russian No 1, Jan 86 pp 67-72

[Interview with Doctor of Economic Sciences Vladimir Pavlovich Tikhomirov, General Director, Scientific Industrial Association "Tsentrprogrammsistem" (USSR); magazine's editorial board's questions are boldfaced]

[Text] Scientific industrial association [NPO] "Tsentroprogrammsistem" was organized in 1974 in the city of Kalinin (USSR). The association solves problems of developing and compiling a centralized fund of algorithms and programs for automated management systems (ASU) of industry sectors, industrial eneterprises, construction and transportation organizations, as well as organizations of the agrarian-industrial complex and of the non-production sector; it also supplies algorithms and programs to users on contracts and trains users in working with programs, as well as develops and implements ASU.

Today functions of the association are being expanded. Not only it performs support, i.e. adaptation of programs to changing operational technical environment, but it also develops software for automated enterprise management systems (ASUP), automated systems for the control of technological processes (ASUTP), integrated automated control systems (IASU), automated design systems (SAPR), flexible automated production systems (GAP), microprocessor systems etc.

The association performs a wide range of scientific research works in the areas of programming, studying economic and social aspects of software, software control.

The association is the country's head organization in programming technology among organizations of the Ministry of Instrument Making, Automation Equipment and Control Systems USSR [Minpribor USSR] and in testing software. It conducts international testing of program packages, developed in accordance with the copperation plan of CEMA member countries.

The editorial board asked General Director of NPO "Tsentroprogrammsistem", Doctor of Economic Sciences V. Tikhomirov to answer some questions, related to the development of program systems.

- Vladimir Pavlovich, it is well known, that the efficient utilization of

computers depends on three conditions: development of computers themselves, development of software for them and the preparedness of the application environment. What is the essence of the problem of correlation between the production of computers and software for them?

- In the USSR, as well as in other CEMA member countries, during the last 30 years computer industry has been created, intensive increase in its output in the future has been planned, the computer fleet spectrum is widening from large and small to mini-computers. In the Soviet Union computer manufacturing is planned, controlled and managed, whereas software (PO) development is not planned on a centralized basis yet. We think, that it is feasible to plan PO in accordance with the total cost of computers. What is the problem? The thing is, that it is hard to determine demand for PO, because it is not only a material, but also a spiritual demand. And in no way can the latter be determined, based on a quantitative assessment alone. Here a deep qualitative analysis is required.

A method for determining the demand by polling ministries and agencies, associations and enterprises, does not give a clear picture. There are other, non-traditional approaches to determining demand. Their essence is as follows: application spheres of various types of computers are thorough analyzed, and a hypothetical model of the application sphere is developed. It is then broken down into individual software components. Now there is a possibility to determine, first of all, the qualitative composition of needed PO, relate it to production of various types of computers as a whole and thus derive quantitative estimates.

By decomposing, the qualitative and quantitative composition of PO is defined more accurately, even though a specific user is not known yet. Therefore a well developed forecasting mechanism is needed. This is one of the approaches to determining demand for software. NPO "Tsentroprogrammsistem" became the first specialized organization for solving these problems.

On the basis of NPO "Tsentroprogrammsistem", in Minpribor USSR centralized funds of algorithms and programs are created in the following areas of computer application: automated control and management systems of various classes; automated design systems; flexible production systems; microprocessor systems.

Satisfying demand for PO is a serious problem. Up till now, the practice existed that when Minpribor USSR was the principal developer of software for automated control systems. At the threshold of the 12th five-year plan (1986-1990) a decision was made to convert a number of organizations into centers for software (PS) development and support. Computer PS are included in the category of products for industrial and technical application.

- Tell us, please, what software as a product for industrial and technical application consists of.

- NPO "Tsentrprogrammsistem" software products consist of two parts: direct programs (PS, algorithms, PS systems, application prototype, automated systems, training course, information from data bases) and service for

mastering and application thereof (delivery, generation, implementation, debugging, individual development, testing and metrology, training, consulting service, processing user's information on developer's computer). Manufacturing of software products is organized on an industrial basis.

- What is the software industry after all?

- First and foremost, the basis of the industry is industrial technology, that covers the entire life cycle of software, from development through application, and organizational support of the technology.

PO life cycle stages cover the following: scientific research work (system analysis, simulation, experiment, writing specifications); experimental design development (writing programs and documentation, testing, building a prototype); organization of support (testing, preparing application documentation, developing training courses, preparing application prototypes; preparing the support group); duplication (organizing a bank of standards, releasing the edition, periodic tests); support (error corection, modification, complex interfacing); application (analysis of functioning, determining the demand for PC development, deriving optimum operating modes).

Industrial technology of PO includes interrelated processes of PO development, support and application, as well as an organized set of regulated procedures (ways and means), that ensure the development of software products as products for industrial and technical application.

It should be emphasized, that NPO "Tsentroprogrammsistem" is a self-supporting association, therefore the following is important to us:

determining properties, composition and delivery procedures, principles of PS classification, pricing of PS as products for industrial and technical application;

determining rules for including into industrial production output volume and reflecting in planning and reproting documentation expenditures for the development and delivery of PS and providing support service therefor;

complex standardization of PS development, manufacturing and servicing;

establishing methods for cost accounting, establishing wholesale prices and planned profits standards, used for establishing wholesale prices for PS production, delivery and scientific technical services.

It is also necessary to develop and implement rules and instructions, that guarantee software quality and economic incentives for the developer in future impelmentation of software.

- What should the structure of NPO for software development and production be like? What is their future? Can the experience of your NPO be "duplicated"?

- There are now several schools of thought as to the development of domestic PO industry. Our experience, as well as the experience of other Minpribor

USSR enterprises, demonstrates, that only those organizations, that possess high scientific, production and personnel potential, can work on developing software on an industrial basis.

In our opinion, scientific research associations will form the basis of the PO industry. Their structure can be as follows. First of all, each NPO includes the head organization, a scientific research institute on PO in the field, in which the NPO specializes (its main objective is forecasting and planning developments, performing scientific research work in the area of creating especially sophisticated PO, jointly with institutes of Academy of Sciences USSR and industry sectors' institutes). One should keep in mind, that expenditures for program support amount to up to 70% of total expenditures for PO development.

Then, an NPO must include a planning and design organization, whose objective is to develop specific complex systems, such as SAPR, ASU GAP etc.

Because it is impossible to deliver PS for all types of computers, except personal computers, without first training users, an NPO must include a training center. Practice demonstrates, that for each delivered PS minimum one or two users-professionals must be trained. NPO "Tsentrprogrammsistem" trains up to 3,000 professionals for each 1,000 PS delivered.

Software, delivered to users, includes a magnetic medium and documentation. Therefore an association should include a printing facility and a copying facility to copy magnetic media. The 10-years experience of NPO "Tsentroprogrammsistem" operation proves the correctness of this approach to structural organization of an association, involved in the development and manufacturing of PS.

As to the prospectives of NPO development and its future, I shall mention scientific research work, performed by our NPO in the area of developing automated software.

On "duplicating" our experience. It is now contemplated to create several organizations, similar to NPO "Tsentroprogrammsistem". I believe, that our experience can be helpful to our colleagues in other countries - CEMA members.

- **How do you see the future of the new sector, the software industry?**

- In my opinion, specialization and division of labor in the PO area will take a path of first creating specialized NPO (specialization in directions, development of software for ASUP, SAPR, GAP and personal computers etc.), then a subsector, whereas the organizational development of the industry sector is a problem for the future. One thing is clear: the sum of all PS in the country must form an interrelated, interconnected and coordinated entity; only such integrity will make it possible to use the potential, that is latent in programs, with acceptable efficiency.

Computer application experience, that has been accumulated so far, leads one to believe, that development of new computers (deciding, what types of computer models should be put in production) must be determined not by

computer development professionals, but by programmers and users. We therefore believe, that it would be feasible to create in our country one or several (according to directions) organizations, responsible for the general policy, PO development methodology, development of a unified system of standards for PO, that meet or exceed the world level, establishing an institution of the general designer of computer software for pursuing a unified technical policy.

As to the question of preparedness of computer application environment: as General Secretary of the CPSU Central Committee comrade M.S. Gorbachov stated at the April (1985) Plenary Seating of the CPSU Central Committee, the decisive role in the implementation of the scientific and technical progress is played by the human factor. Professional training and skill of employees in material production and in the non-production sphere, their computer literacy, mastering informatics in high schools and colleges, and, first and foremost, the psychological tuning of people, especially managers at all levels, their deep understanding of the necessity of computerization as the scientific and technical progress catalyst, personal interest in its development - all these factors decisively affect the efficiency of computer applications today. To this end, a tedious complex ideological, educational work and a thoroughly thought out systematic personnel training are necessary.

- In his speech at the meeting of the most active members of Leningrad Party organization, comrade M.S. Gorbachov stated, that experience is a priceless common property of the people of the sister nations. In recent decisions of the CPSU Central Committee and the USSR Council of Ministers, a high priority is given to problems of developing direct links between enterprises. Could you tell us about this, using NPO "Tsentroprogrammsistem" as an example?

- Direct links, that we have established, are real contacts, supported by real resources and real business agreements. We envision means for improving thereof in further coordination of activities in the area of PO development and creating a joint fund of programs. Organizationally, this could be done in the form of a self-supporting association, whose functions would be creating a fund of programs and helping organizations and enterprises in CEMA member countries in using this fund. The structure of the international association could be the same as I have described above: a developed research base, a planning and design bureau, a training center and printing equipment. On the basis of such organization one can solve an important problem, that of forming international creative groups for PO development.

- Today we can say, that the basis of software industry has been created. In our conversation you have told us about its problems and prospectives. What is the social order, given by industry to fundamental sciences for the development of "artificial intelligence"?

- Today we already can formulate the order. First of all, it is to perform research in such areas as developing the theory of PO quality, creating an economic mechanism in software industry, forming scientific foundations for developing technological processes and organizational structures, further development of programming science, developing methodology for determining social demand for PO.

(1) Область применения	(9) Виды ПС, %		
	Базовые (10)	Общего назначения (11)	Прикладные (12)
(2) АСУП	6	40	54
АСУ ТП (3)	14	52	34
(4) САПР	6	58	36
АПК (5)	4	40	56
(6) Медицина	3	30	67
ИАСУ (7)	7	41	52
(8) Персональные ЭВМ в управлении	4	34	62

Figure 1. Relation Between Various PS Types in Information Systems (based on functional models)

Key:

1. Application sphere
2. ASUP
3. ASU TP
4. SAPR
5. APK
6. Medicine
7. IASU
8. Personal computers in management
9. Software types, %
10. Basic
11. General application
12. Applied

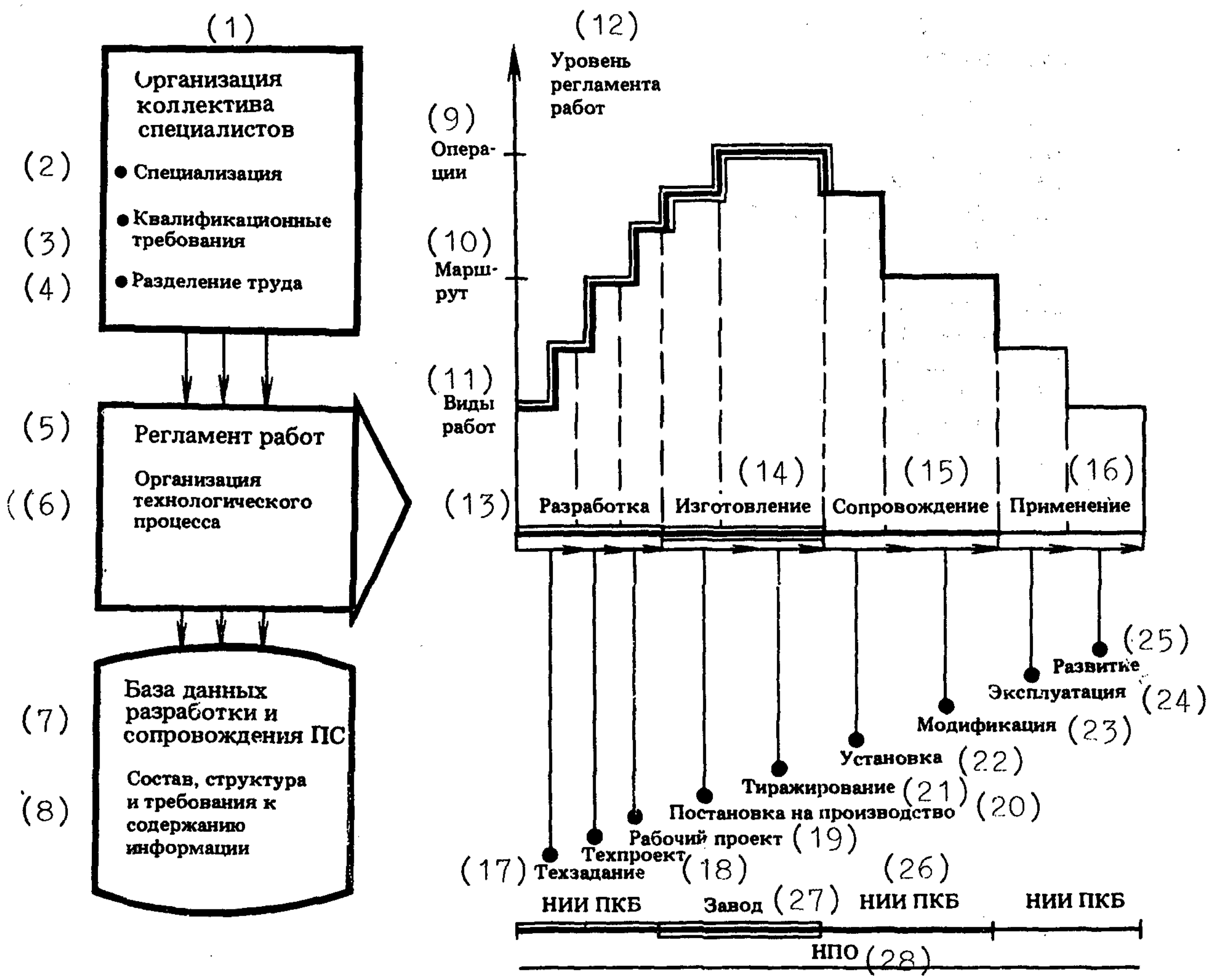

Figure 2. Organizational Support of Technology

Key:

1. Organizing a group of professionals
2. Specialization
3. Qualification requirements
4. Division of labor
5. Operating rules
6. Organization of a manufacturing process
7. Data base for PS development and support
8. Composition, structure and requirements to information contents
9. Operations
10. Route
11. Types of jobs

(Key continued on following page)

12. Operating rules level
13. Development
14. Manufacturing
15. Support
16. Application
17. Design specification
18. Detail design
19. Contractor design
20. Production start-up
21. Duplication
22. Start-up
23. Modification
24. Operation
25. Expansion
26. NII PKB [scientific research institute, planning and design bureau]
27. Factory
28. NPO

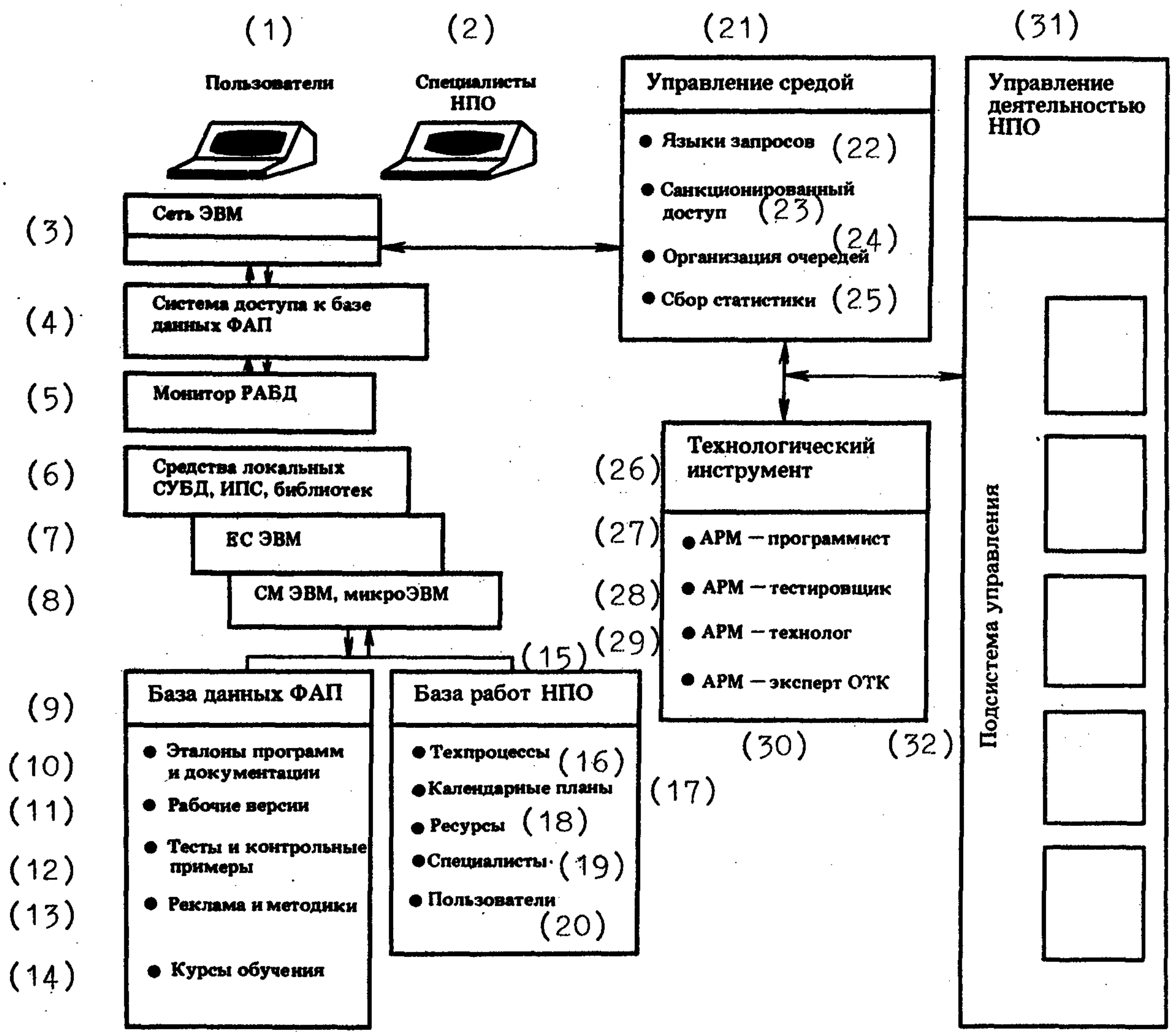

Figure 3. Automated NPO

FAP - Fund of algorithms and programs
RABD - Distributed automated data base
SUBD - System for control of data bases
IPS - Information retrieval system
ARM - Automated workstation

Key:

1. Users
2. NPO professionals
3. Computer network
4. FAP data base access system
5. RABD monitor

(Key continued on following page)

6. Devices of local SUBD, IPS and libraries
7. YeS EVM [Unified System of Electronic Computers]
8. SM EVM [International System of Small Computers], microcomputers
9. FAP data base
10. Standards for programs and documentation
11. Working versions
12. Tests and test examples
13. Advertisement and procedures
14. Training courses
15. Operational basis of NPO
16. Manufacturing methods
17. Calendar schedules
18. Resources
19. Professionals
20. Users
21. Control of the environment
22. Request languages
23. Sanctioned access
24. Queue organization
25. Statistics aquisition
26. Manufacturing tools
27. ARM - programmer
28. ARM - tester
29. ARM - process engineer
30. ARM - quality assurance expert
31. Management of NPO activity
32. Management subsystem

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APPLICATIONS

SYSTEM 'ATTENTION'

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 7, 8-21 Apr 86 p 6

[Article by I. Yermolayeva, under the "Institute of a Human Being" rubric; pictures by Yu. Andreyev; Ufa]

[Text] Personnel turnover has decreased more than twofold, and among newly employed by a factor of 3.5, the annual profit of the enterprise is about 2 million R - such are the results of the implementation of the "Attention" system at Ufa industrial association imeni S.M. Kirov.

The Ufa industrial association, a manufacturer of modern telephone equipment, starts ... at a psychologist's office. For those, who decided to leave the association, it also ends with the meeting with a psychologist. And then the psychologist asks him- or herself a question: have we done everything for the person to feel well here?

Is it worth to torment oneself?.. People quit for all kinds of reasons. Wages are too low, an appartment has not been given, there is no kindergarten... At Ufa PO [industrial association] they thinked the same, or almost the same way. But they have built a new association's plant nearby. The employees were given good wages, housing, but people have not stayed with the company. So, these are not the only reasons.

It was then, that the Ufa association invited psychologists and sociologists, who, after the very first research, came up with figures, that surprised everybody: only 10 percent were quitting due to unsolved social problems, whereas the rest was quitting mainly due to critical situations in the collective and to "breakdowns" in industrial relations. That is how a new index of association's performance, the human factor, emerged.

The research was going on, producing new figures. Only one third of those, who were coming to get a job, were able to stand the two-week long wandering and waiting. We all know, how much time and effort has to be spent to simply take a picture for an ID. Today it takes only a day and a half to fill out all papers, and the second day is considered a working day. It is quite real, when not you, but people from the personnel department are the ones, who are waiting, because the enterprise needs an employee, not just the employee needs an enterprise. The hiring procedure is literally scheduled by the minute: one

employee is familiarizing the new person with the shop, the other one is filling out necessary papers, the photographer is clicking the shutter. The next day - a medical examination, necessary instructions, free lunch, visiting the association museum, watching a movie on the association history. Besides, a psychologist fills out a card of operative registration of personnel, marks down, where a new person has come from and why he or she came here, and not to some other place, how many jobs he or she has changed, what his or her housing conditions are... And this is being done not out of curiosity. The data are coded and entered into the "ASU-Personnel" system. Along with an ID, the novice is solemnly given an "Adaptant's Certificate", which is efective during his or her first year of employment. The adaptant is given the closest attention by psychologists, as about 70 percent of those who quit left within the first several months: there were not enough tools, uniforms, sometimes even workstations for them, they were given odd chores, and, as a result, the wages were also disappointing.

An adaptant is a special person, a privileged one, who is guaranteed to be paid a certain level of wages and to be provided with everything, that is necessary for working according to his or her specialty, at the same level as experienced workers are. Nobody has the right to make him or her to do any odd jobs. If he or she needs it, the adaptant will be given a nursery or kindergarten pass for a child, a dispensary or sanatorium pass for him- or herself.

A shop psychologist (there is such position now), adaptants' curator, public adaptants' council do everything possible to help a novice to join the collective, to undergo a difficult at times process of industrial acclimatization, a process of getting used to the new environment. In specially equipped psychological relief offices one can shed tiredness, calm down. There is also a "psychological emergency service", a "sympathy" service: you call up the number, and a psychologist on duty is always ready to listen to a person in need of such help and to intervene on the spot.

The "Attention" system forced everybody to revise such concepts as, for instance, a plan. Is this the quantity of manufactured products? Yes, it is, but first of all this is people, who accomplish the plan quota. Therefore a manager, a foreman, as well as a shop superintendent, must care about creating a conducive, "high productivity" microclimat, take into consideration all aspects of the human factor. Psychological studies data proved the need to drastically change business as usual, pay attention to what seemed to be "minor" details.

Is person's mood the person's personal problem? But, according to some data, a bad mood can cause a 20 percent or more drop in productivity. If this person works on a conveyor line, the performance of 10 to 20 people is paralized. And a casual, unreasonable call to a manager's office can unsettle and disable for 25-40 minutes. Only 15 percent of manager's success depends on his or her technical knowledge, the rest depends on his or her skill in working with people.

"The words "operatorless technology", "automation", "robotization" are mentioned more and more often. Should one get concerned with human psychology

in production?" I asked the General Director of the association R.A. Gareyev.

" When we started the implementation of the "Attention" system several years ago, a lot of people considered it to be a temporary vogue undertaking. But when personnel turnover dropped from 18 to 7 percent and ceased to be our problem, the experiment has proved, that it was vitally needed. And it is no accident, that today, when we have embarked on the course of scientific and technical acceleration and intensification of the economy, the CPSU Program says, that the party links successful solution of contemplated problems to the increased role of the human factor".

Scientific and technological development, increasing sophistication of production cannot but affect human communications and contacts, as well as psychological problems of industrial relations. The embarked course of scientific and technical acceleration requires the maximum utilization of human abilities. A worker has always been and still is the main productive force, which means, that conditions should be created, that would induce this force to be highly productive. The "Attention" system and further studies of the inexhaustible production reserve, the human factor, the knowledge of natural laws thereof have been and will be helping us to solve a lot of problems.

The Large Soviet Encyclopedia defines the "human factor" as just a technical characteristic of the "human being - machine" system interaction. After the April (1985) Plenary Seating of CPSU this term has acquired a new, much deeper socio-political meaning. Studies of various aspects of worker's personality are coming to the forefront. Great attention is paid to using socio-psychological approaches to a human being in production. This tells us, that a new science of managing human relations in the labor process is being born before our eyes.

But let us go back to the Ufa association. The "Attention" system is not at a standstill, it keeps developing. Psychology ever more enters the world of technology, and technology in turn helps psychologists and sociologists. For instance, the ASU-"Adaptant" system is being implemented, which will make possible to more rapidly analyze personnel information, identify stable regularities of personnel movement.

Psychologists are also interested in the problem of personnel selection and placement. Professionals contend, that professional fitness prognosis can be successfully based on person's emotional attitude to the selected profession. That is why association's psychologists are developing a profesional consultation procedure, which will use video-technology to demonstrate to those applying for a job specific features of various workers' professions: the character and object of labor, the level of intellectual saturation...

The selection of "the most liked" profession will be supported by effective education. Therefore association's psychologists work on developing methods for purposeful programmed forming of theoretical knowledge and simulators for developing practical skills.

Pictures:

Lower right: A simulator, developed by association's professionals, helps in transmitting the experience of professional installers to novices.

Upper right: Manager of the Department of Psychology and Sociology Yuriy Georgiyevich Shiryayev is always ready to help his associates.

Lower left: What kind of problems are bothering an adaptant? The "Attention" service psychologist Nazira Valiyeva is talking to an electronic blocks adjuster Viktor Koshelyev, who has been working at the association for less than a year.

Upper left: Visiting a psychological relief office is especially needed by workers in a "noisy" department, such as a stamping shop. Raisa Galeyeva is conducting a session.

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INFOGRAPHICS OF PLANNING AND MANAGEMENT IN CONSTRUCTION

Moscow NA STROYKAKH ROSSII in Russian No 3, Mar 86 pp 18-21

[Article by A. Gusakov, doctor of technical sciences, professor, chairman of the department of management and systems engineering of VIPKenergo, USSR Power Ministry, L. Lebedeva and V. Chulkov, candidates of technical sciences, senior science workers, TsNIIproyekt, Gosstroy SSSR]

[Text] Computerization and the development of automated systems in construction requires imaging (visualization) of the intermediate and final results of engineering calculations that have been done in planning and management. Such computer-graphic support of decision-making personnel is implemented by imaging the various planning and management characteristics in the form of planning charts (diagrams, histograms, two-dimensional, three-dimensional and other graphs) that enable not only quantitative, but also qualitative validation of the viability and efficacy of automated systems in construction.

conventional machine graphics facilities that have at their disposal a large body of algorithms and software for a variety of imaging tasks are no longer adequate for effective computer-graphic support for the following reasons:

machine graphics is increasingly becoming a division of computer technology, and its development is realized in the form of graphic participation in service operating systems, rather than being directed to handling conceptual sector-wide tasks;

The rapid development of visualizing hardware and software, and the improvement of interactive capabilities are opening up new possibilities for developing artificial intelligence systems, utilizing both formal logic and intuitive experiential values;

the integration of automated systems requires a comprehensive approach to graphic support of SAPR OS [Computer-Aided Design System of the Construction Sector] and ASUS [Automated Construction Management System];

enhancement of the productivity of creative labor entails improvement of the entire process of graphic information exchange, and in particular an increase in the clarity of alphanumeric data accompanying planning charts.

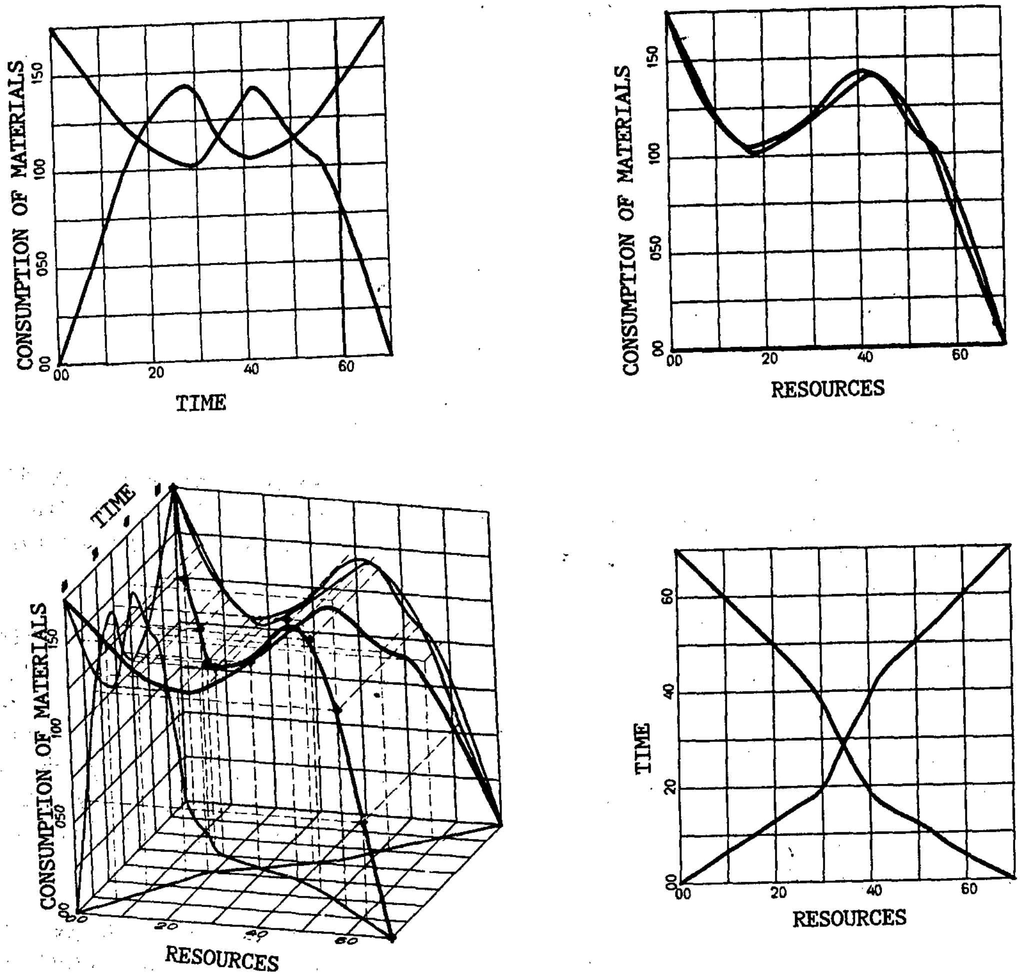

Fig. 1. Two-dimensional and three-dimensional graphs of functional relations (resources means labor resources)

Further development of machine graphics and elimination of the factors limiting its capabilities involves the formation of infographics (informational graphics) -- a new division of the just as new practical-science discipline of informatics that has not only been rapidly developing in the Soviet Union, but has found terminological reinforcement in the titles of special academic courses in intermediate and higher education, in the titles of books, texts and journals, and in the name of a new department of the USSR Academy of Sciences.

Informatics and its subdivision infographics as a new technology of information resource processing play a major role in the construction sector, which is one of the most information-intensive sectors of the national economy, and they are characterized by a distinctly specific nature that complicates the use of information resources.

A team of specialists including A. Gusakov (team leader), L. Lebedeva, G. Maksimov, Ye. Pavlova, V. Chulkov and others has been working for a number of years on developing a standard software package for machine graphics: it may become part of the software of informatics in construction.

The following standard graphic programs have been compiled:

basic graphic routines (organizing drawings, textual information, tracing sketches, affine transformations);

processing data from an encoder (input of initial information, marking the object during input, on-the-spot correction of the coordinates of an object, shading closed regions of arbitrary configurations, plotting correlations, changing the angle and weight of shading);

plotting various technical-economic graphs (two- and three-dimensional, surfaces, envelopes of correlations, and so on);

creating a system of algorithms of three-dimensional graphics (three-dimensional affine transformations, orthogonal projection, construction of façades, plans, profiles, axonometric projection, perspective projection from any viewpoint, and also parallel and central projection onto a plane that is nonorthogonal to the line of sight);

sketching administrative information (calendar quotas, CPM charts, sequence diagrams, histograms, diagrams of resource characteristics);

drawing maps of isolines (forming a digital model of terrain, determining altitudes of a surface at the intersections of a coordinate grid with respect to randomly placed points, plotting projections onto planes);

laying out thematic charts, master plans, general building plans (compiling express charts that depict various economic indicators, the distribution of indicators by oblasts and republics), and also constructing stereo drawings of different building projects.

Informatics, or the graphic support of software, is the natural extension and development of information retrieval systems. It extends the capabilities of interaction of the user with the system, raises the level of service and the creative ease of specialists in working with the data they require, shortens deadlines, improves the quality of decisions, and provides output of results in a conveniently readable form.

The hardware of infographics of specific CAD systems or ASUS is determined by the set of graphic I/O devices that ensure completeness, quality and proper timing of the visualization tasks being handled within the scope of a given system.

Mathematical and linguistic bases support exchange of information between user and system. The principal components of such a base are the languages of specification of the technological arrangement and the modes of operation of the graphic part of the CAD system and ASUS.

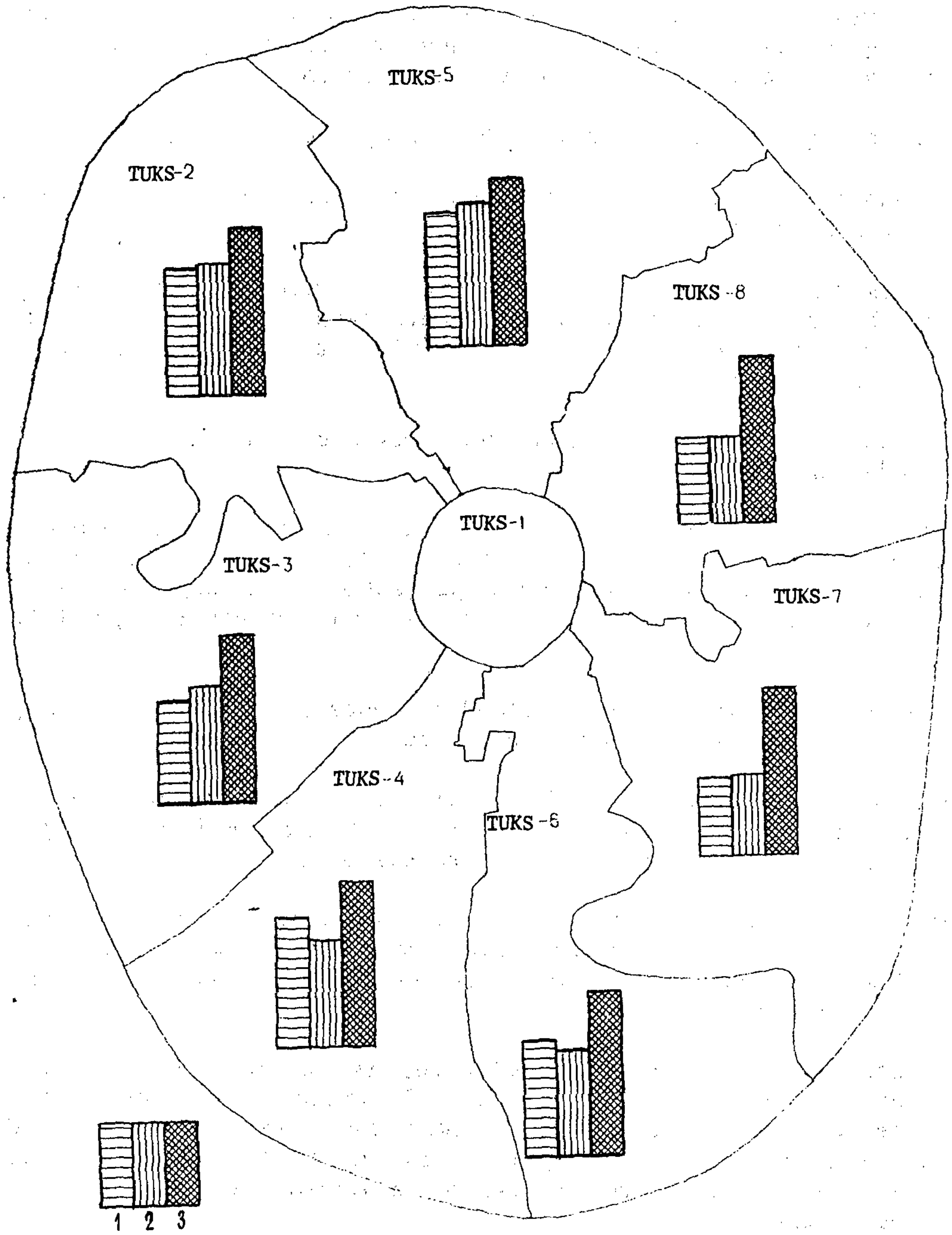

Fig. 2. Chart of ongoing supervision of the work of territorial administrations of capital construction [TUKS] of Moscow: 1--plan according to data of the Main Administration of Capital Construction [GlavUKS]; 2--actual work completed according to GlavUKS data; 3--annual GlavUKS quota

The hardware and software of graphic interaction with the computer must be chosen in accordance with the requirements for handling the assigned task. Graphic

functions are defined that are solved by hardware or software means. For example, a video processor may interact with the ROM, which may be used to reproduce an image of the entire screen of the display, individual parts, or scrolling. The software -- the most capacious and portable part of informatics -- includes application-specific programs for graphic input, interaction, and also interfacing of graphic patterns with the computational characteristics of the tasks to be done.

Informatics can be represented not only as visualization of the existing contents of databases, but also as the capability of active graphic interaction between the user and existing information to solve a variety of problems in technology, organization, economics and computer-aided planning and management. The results of this interaction may supplement the graphic database.

Planning and management decisions are made via several iterative steps of graphic interaction based on graphic data that contain the description of geometric patterns, and also relations and rules for their various transformations and interfacing of computational data with the corresponding graphic models.

Graphic semantic models (frames) are the logical description of the structure of data for visualizing a stereotyped situation. These models already incorporate answers to the following queries:

how is the given graphic model to be used?

what graphic image should be expected at the next instant?

what graphic transformation should be executed if the prediction is not validated?

The network structure of frames creates the basis for the graphic database. Description of the graphic images on the logical level opens up new possibilities for creating a user interface as well.

Associated with the hardware is the capability of forming multiplicative informatics facilities. Each section of the ROM that is allocated to the screen may have the form of a moving image (sprite) controlled by the video processor. Control and tracking of moving sprites by the video processor enables creation of business video games in informational support systems for decision-making personnel. The creation of such video games is a promising application of informatics and needs special study.

To visualize intermediate and final managerial decisions through information that is territorially distributed, a software system has been developed for plotter output of various thematic charts with divisions by economic regions, republics, oblasts, and with imaging of statistical data in the form of cartograms, diagrams, histograms, symbols, pie charts and the like.

The described standard software packages were put through experimental validation in a number of institutes of Gosstroy SSSR in the period from 1976 to 1985, and have been introduced in 63 organizations whose business involves construction planning and organization of the building industry.

An example of graphic aids to scientific research in administrative work and economic developments under conditions of informatics is the combination of two- and three-dimensional plots of functional relations (Fig. 1). A system of such graphs reinforced by a database provides the user with all the required information about the dynamics of the process.

A second example of informational-graphic support for decision-making personnel is a chart of ongoing supervision of the construction conveyer of Moscow plotted by order of the Main Administration of Capital Construction [GlavUKS] of the Moscow Municipal Executive Committee, and a program by means of which any information for ongoing supervision of the work of territorial administrations of capital construction can be represented in textual or graphic form at the user's discretion (Fig. 2).

The cited procedural points and practical examples of informatics do not exhaust all its capabilities.

Further research and development in problems of informatics, facilities for interfacing graphic and computational algorithms, databases and knowledge banks, hardware and software for visualization can be brought to a qualitatively new stage of computer-aided and informational planning and management systems in construction.

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CSO: 1863/330

DIGITAL IMAGE PROCESSING

Riga NAUKA I TEKHNIKA in Russian No 6, Jun 86 pp 6-8

[Article by Leonid Petrovich Yaroslavskiy, doctor of physical and mathematical sciences, deputy chairman of the laboratory of digital optics, Institute of Information Transmission Problems, USSR Academy of Sciences]

[Text] Leonid Petrovich Yaroslavskiy (born in Kharkov in 1940) is deputy chairman of the digital optics laboratory of the Institute of Information Transmission Problems, USSR Academy of Sciences, and is a doctor of physical and mathematical sciences. He graduated from Kharkov Polytechnical Institute in 1961 with a major in radio engineering. He is the author of more than 100 scientific papers, including several monographs.

"The living behavior of a human being depends on the senses, among which the sense of sight is the most diversified . . . inventions that enhance this sense are of the greatest utility . . ." Such was the opinion of R. Descartes more than 350 years ago regarding the invention of the telescope.

We are now equipped with much more highly developed optical instruments. We have witnessed the advent of television, holography, ultrasonic and electron microscopy, radio, neutrino and gamma telescopes, computerized x-ray tomographs, nuclear magnetic resonance tomographs, and a host of other wonderful and remarkable inventions. These enable us to view far-off objects, to reproduce bodies in three dimensions, to penetrate into their internal structure on the molecular, and even on the atomic level, to visualize the temperature distribution on the surface of an object, the density of a radioisotopic substance in tissues, and so on. But now, it no longer suffices merely to alter the shape of a physical signal in order to see the invisible. In most cases, extracting the information hidden in an emission signal and converting it to an image accessible for interpretation necessitates transformation of the informational structure of the signal. This is what we call image processing.

The conventional means of image production -- optical, photographic, and television facilities -- pertain to the so-called analog approach to signal processing in which any signal transformation preserves continuity: a small change in the signal being transformed corresponds to a small change in the result of transformation. In this context, complete analogy with the initial signal is retained on any stage of processing

The latest computer technology -- general-purpose and specialized digital computers and digital processors -- are now being increasingly relied on for image interpretation. Images are converted to digital signals, i. e., to a sequence of numbers that take on specific values. This disrupts strict analogy between the initial image and the digital signal that represents it: the digital signal remains unchanged as image brightness varies over a certain range. This means that the signal describes the image only with approximate accuracy. In compensation, digital signals are resistant to internal interference: interference that is not excessive becomes entirely unnoticeable, whereas in the analog processing system, conversely, a signal change is unavoidable. But the main advantage of digital image processing is in the versatility of digital systems: reprogramming the machine suffices to change the processing method. In doing so, the physical structure of the machine and the configuration of the system remain as before (in the analog system, everything has to be reconfigured: some components removed, others put in, the hookup altered, and so on). Therefore, the digital processing system can be easily made interactive, and affords flexibility and immediacy in alterations depending on results.

Digital image processing came into use in the late fifties to early sixties. Universal digital computers had made their appearance not long before, and they had begun to be used for simulating image transmission systems and various methods

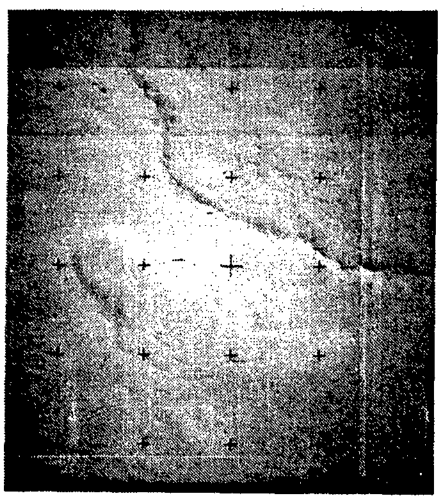
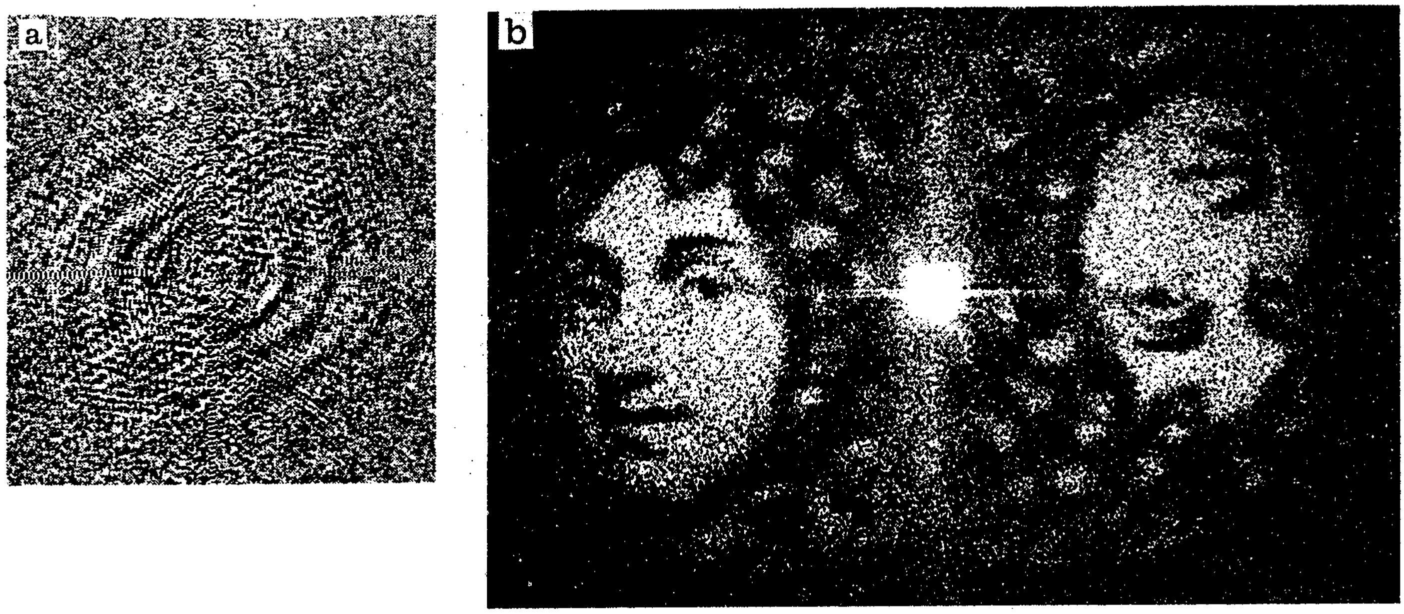


Image of the surface of Mars transmitted by the "Mars-4" interplanetary probe

The same picture after processing (glitches, stripes, background nonuniformities and pulse interference have been eliminated



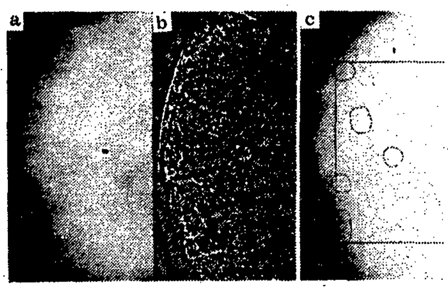
Synthesized digital hologram (a) is illuminated with a laser beam, and the original image (b) is reconstructed

of image coding for transmission (although it is worth recalling that the first notions about digital image transmission go back to the twenties). With the development of computer technology it became clear that digital computers could be used to do other jobs as well: correcting distortions, recognition and measuring image parameters. Digital computers have been used for interpreting the tracks of elementary particles produced on accelerators; in machine graphics, where computers have synthesized images for automating engineering design, in processing video information coming from space vehicles. Finally, by the mid seventies, thanks to development of a microelectronic base for computers and the extensive use of minicomputers and microprocessors, specialized systems appeared for digital processing of images, and they began to be widely used in scientific research, medicine and industry. The capabilities of optics were extended by new ranges and kinds of measurement. Via electronics, optics is penetrating into the informational essence of radiation. Devices with computer facilities are now being used for enhancing not only the optical properties of sight, but the analytical capabilities of this sense as well. To extract and analyze the information included in images, computer-aided image processing systems [CAIP's] are being developed. To get an idea of how they operate, let us look at their individual components.

The central processor subsystem is the "brain" of the CAIP. As a rule, the function of this subsystem is performed by a general-purpose computer, usually in the class of so-called minicomputers, and lately, microcomputers as well. The concepts of minicomputers and microcomputers are rather arbitrary, as their computing capabilities exceed those of some "large" computers used ten years ago. The main thing for a computer operating in a CAIP is its exclusive use for processing images, and necessarily in the interactive (dialog) mode. Moreover, the central processor controls other subsystems. The computer's CAIP "brain" may be

supplemented with specialized processors, e. g., for high-speed execution of arithmetic and matrix operations, Fourier transformations and so on.

The image input subsystem is the "eye" of the CAIP. It converts the input image to a digital signal. These devices generally operate on the scanning principle: a sensor looks at the image point after point, measuring its brightness in individual picture elements. The brightness values of the points are recorded in the binary system of notation, and enter the central processor as a digital signal. Usually, on the order of a million such numbers are required for a single image, with eight binary digits allocated for one brightness sampling. Frequently other physical parameters associated with image brightness, such as the density of blackening of a photographic negative, are measured for image input.



Digital processing enables detection of trace calcinates in the mammary gland: a--x-ray photo of mammary gland; b--processed photograph clearly showing bright white spots -- trace calcinates; c--initial image with regions of trace calcinates marked (circled)

The image output and documentation subsystem is responsible for reverse conversion of the digital signal to a document image: a photograph, figure, diagram or table. This subsystem includes various kinds of plotters and printers, and also special photographic recorders for producing a negative or photoprint of the image obtained by processing. Light-sensitive material is exposed point after point, the amount of exposure being determined by the digital signal coming from the central processor.

The interactive facilities and display processor subsystem supports interaction between the user and the central processor. A distinguishing feature of interaction is that the system must "converse" in the language of images, using both the simplest graphic and typed form, and complex half-tone and even moving and three-dimensional pictures. Therefore, in addition to the graphic and typed-language terminals that have now become conventional for modern computer equipment, the subsystem incorporates specialized devices: display processors that enable production of a high-quality color or black-and-white image on the screen of a television monitor, containing up to 512 × 512 elements with 256 brightness values in each of three colors: red, blue and green. In addition, the display processor is equipped with its own digital processor for ultrafast image processing, its own memory for storing several frames, and also a functional keyboard, special controls and other means by which the operator may control the system.

Peripheral storage subsystem. One of the main distinguishing features of digital image processing from the standpoint of organizing the computational process is the enormous volume of numerical data. Therefore, high-capacity storage devices are a must in CAIP's. As a rule, those based on magnetic tape are used for archive data storage, while others based on magnetic disks are used for routine image processing. For the fastest acquisition of stored data, the storage devices are usually connected to the central processor by what is called a direct-access channel.

Use of digital image processing. A triumph of science has been the first photographs of the opposite side of the moon; pictures, including color images, of the surface of Mars; photographs of Jupiter, Saturn and their satellites, and of the surface of Mercury. Quite recently the first color panoramas of Venus were obtained, as well as radar images of the polar region of this planet, and photographs of Halley's Comet at close range. This has been made possible owing to special digital processing of the signals received on earth to correct the distortions that arise as the planets are being photographed by the television and phototelevision equipment carried by unmanned interplanetary probes, and during the transmission of these signals across tens and hundreds of millions of kilometers by radio channels.

Photographs obtained by astronomical telescopes also require special processing and correction. After all, the resolution of modern large telescopes is limited not so much by their design, as by the properties of the atmosphere. Because of the variability of the atmosphere (think of the "twinkling" of stars!), we cannot get sharp images, distinguish a binary star from one that is solitary, or see details on the surface of planets and their satellites. Thanks to the capabilities of digital processing, astronomers have come up with techniques for restoring the sharpness of images. Now the quality of these images approaches that of photographs taken in vacuum.

Digital processing is especially effective for correcting distortions with unknown parameters that need to be established directly from the image. In this case, interference and distortions are first automatically diagnosed, thresholds of interference processing and filter parameters are determined, after which comes the correction proper.

Moreover, to facilitate visual interpretation, the image is usually subjected to additional processing that suppresses some details and enhances others, with quantitative changes in the image, alteration of the type of projection, and so on. This is called preprocessing, and it is done in the interactive mode. Digital image processing has no competitors when it comes to the wealth of its capabilities.

At the present time, artificial satellites and flying laboratories are making mass surveys associated with research and keeping track of natural resources and the environment. In this field, the main goal of digital processing is automated and completely automatic image interpretation and recognition.

The necessity for mass processing of aerospace information has necessitated setting up special centers equipped with a variety of digital computers of different classes, archives of digital video information, systems of documentation and dissemination of results, and interactive processing aids.

There has been a radical change in the entire working style of specialists in sectors of the national economy who are users of satellite video information. For example, geologists have long been accustomed to working with aerial photographs, but now they are beginning to analyze them by using color and black-and-white displays, and systems that perform all manipulations on the image.

New digital equipment for processing signals, shaping and processing images is being adopted in medical diagnosis along with new bands and types of radiation. The most outstanding example in this field is computer tomography, a method of getting images of cross sections of the body from measurements of the radiation absorbed by the body. Medical instruments -- computerized tomographs -- have also made their appearance, providing the unique capability of examining the internal organs of the human body in "cross section," without resorting to the scalpel [see NAUKA I TEKHNIKA, No 4, 1985 -- **editor's note**]. Conventional x-ray diagnosis is likewise beginning to feel the need of digital image processing. The new techniques are necessary, for example, to see tiny or low-contrast details on photographs, thereby avoiding injection of so-called contrasting substances into the tissues, and enabling detection and diagnosis of pathological formations on various stages of occurrence, monitoring changes in tissues during treatment, automating mass examinations of the populace.

An image is the most convenient form of data representation for any experiment. Therefore the productivity and scientific benefit of a researcher's work are determined by the speed and accuracy of processing the visual information obtained. For example, physicists use digital processing of the images of tracks of nuclear particles to classify them and determine their numerical characteristics; in biology and the science of materials, microscope distortions are corrected, and microstructures are recognized (see NAUKA I TEKHNIKA, No 3, 1979 -- **editor's note**]. Automatic processing of interference patterns enables determination of the electron density in plasma, strain on machine components and models of structural components, and so on. The methods and technology of computer-aided image processing are starting to be widely put into production, where they are being used for automating design in machine building and electronics, for controlling robots, nondestructive quality control of machine building items, and supervision of technological processes in plants of the microbiological and chemical industries.

Digital image processing has been transformed into a convenient, flexible and highly productive tool of the arts, it has become the basis of new technical facilities in television and motion pictures. The display aids with the choreography and the selection of steps when producing ballets, it is used in evaluating old black-and-white films, and in work on "multifilms." The first such Soviet film, "Paradoxes in Rock Style," was produced at the "Soyuzmultifilm" Studios by the well known director E. Hamburg. This was done in the following way: individual frames were calculated on a computer, and the artist sitting at a a color display designed -- no other word will do -- the play of colors in a sequence of frames, easily and quickly choosing the necessary variant from a rich palette.

Digital processing is also extensively used in restoring one-of-a-kind archival photodocuments and identifying eminent works of art and architecture in the largest museums of the nation.

Many of the special effects recently used on television (split screens, panning, informative insets and the like) have become possible thanks to digital television processors. Three-dimensional holographic television is of the greatest interest and promise. The path to development of this technique lies through the methods of digital holography that allow the hologram of objects to be constructed from their mathematical description (information about the shape, placement in space and illumination), and then enable reproduction of a three-dimensional color image of the objects.

Thus, in the most general outline, digital image processing can be represented as a new direction in experimental science that in future will undoubtedly become a component part of modern technology.

Automated image processing systems are to become a primary tool of the scientist, designer, technologist, television and motion picture director. College and university students will learn to use them. General-purpose computers for image processing will make their appearance that will organically combine the advantages of analog and digital systems.

Certainly, digital image processing is a great technical invention that may solve many of the major problems facing science.

6610
CSO: 1863/329

CLASSIFIERS AND DOCUMENTS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 86 (signed to press 5 May 86) pp 1-27

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[Text] I. SOFTWARE FOR AUTOMATED CONTROL SYSTEMS. GENERAL PROBLEMS OF CLASSIFICATION, CODING AND THE UNIFIED SYSTEM OF DOCUMENTATION

UDC 658.562.014:002:681.3

PROBLEMS OF GLOBAL CONTROL OF INFORMATION QUALITY IN PRESENT-DAY COMPUTING SYSTEMS AND NETWORKS

[Article by V. A. Gerasimenko, doctor of technical sciences, MGIAI (not further identified), and V. I. Tairyan, candidate of physical and mathematical sciences, Armenian Affiliate of the All-Union Scientific Research Institute of Problems in Management Organization]

A question of some urgency at present is how to bring about a dramatic increase in the scales and level of application of computer technology in all spheres of the national economy of the USSR. The practical implementation of this task necessitates solution of a number of complicated problems, one of which is the issue of ensuring the necessary quality of information. The very concept of the quality of information as it relates to present-day computing systems and networks is changing in comparison with the interpretation of this concept during the period when the main form of utilization of computer technology was localized computer centers and automated control systems. As applied to local systems, the validity of information was taken as the main characteristic of its quality. Validity of information was understood to be a measure of the extent to which it remained undistorted and was not lost during handling, storage and processing. At the present time when dealing with accumulation and fixed storage of the bulk of information on machine-readable media, large-scale automation of information

processing, direct user access of information, ubiquitous conversion to sharing and networking of computer facilities, i. e., at a time when fundamental quantitative and qualitative changes are taking place in the use of computer technology, validity of information in the traditional meaning of the concept does not correspond to all demands made on the quality of information in present-day computing systems and networks. The quality of information in modern computing systems and networks can be evaluated with the required completeness only by using an aggregate of indicators, as shown on Fig. 1.

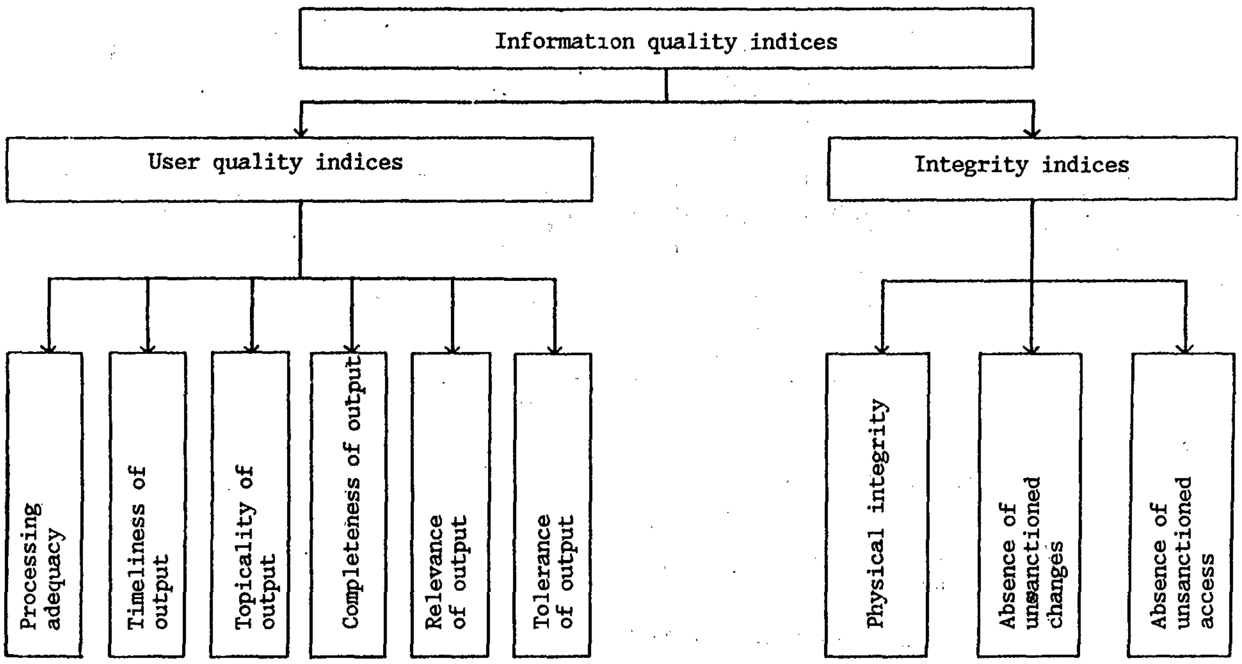

Fig. 1. System of indices of information quality in modern computing systems and networks

Such considerable changes in the system of information quality indicators require corresponding equivalent changes in approaches to assurance of this quality. The essence of the changes is this: while validity of information in localized systems could be ensured by using some set of facilities, high quality of information in present-day computing systems and networks can be ensured only if a special, regularly operating mechanism for controlling quality is in place [1, 2]. The basic principles of the systems-concept approach to developing such a mechanism are illustrated on Fig. 2.

The function of controlling information is understood to mean a set of functionally uniform steps (routines, tasks) regularly performed by personnel who may use the facilities of the information system (network) to organize and ensure control of information quality with respect to the entire set of indices. There is no rigorously formal machinery for generating a set of control functions, and therefore one of the following techniques is suggested for listing the functions of controlling information quality based on informal heuristic methods:

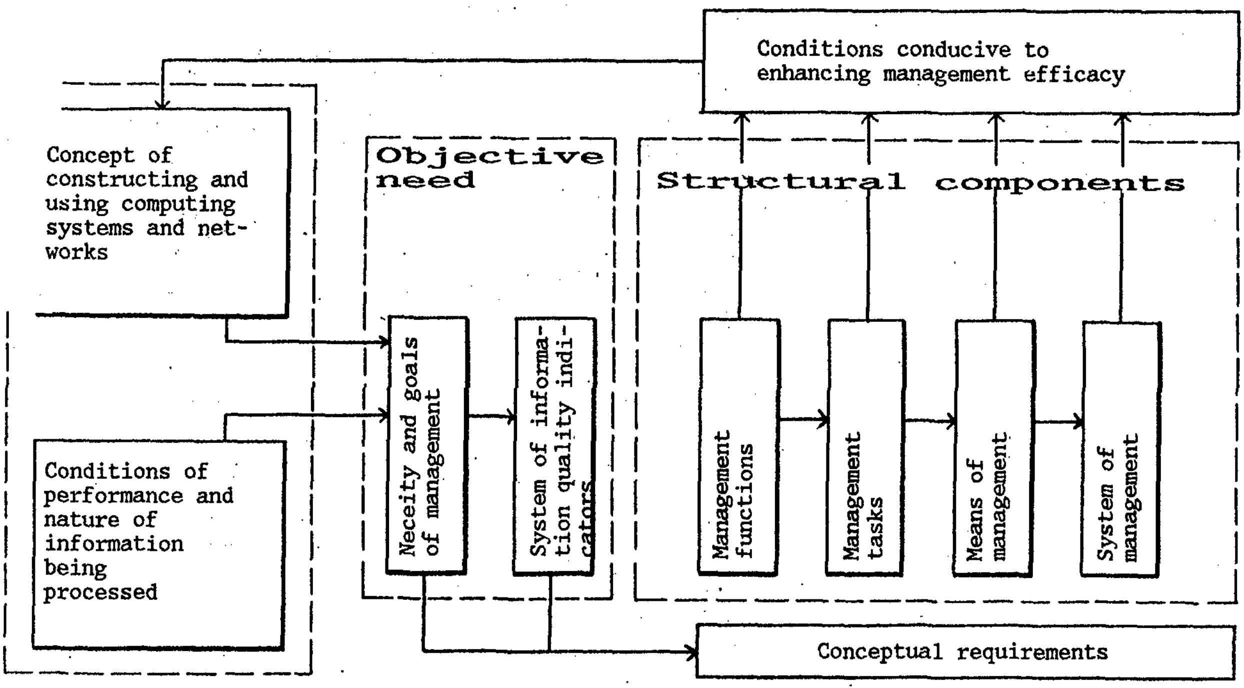

Fig. 2. General structure of systems-concept approach to control of information quality

setting up conditions for ensuring the necessary quality of information;

maintaining conditions that ensure quality of information;

checking the quality of information;

preventing deterioration of information quality;

minimizing deterioration of information quality;

restoring the quality of information to the required level;

improving the mechanism of ensuring prescribed information quality.

The control task is defined as the set of routines that ensure execution of the finished (independently operating) part of the control function. The following classes of tasks in control of information quality are distinguished: setting up the mechanism for ensuring prescribed quality of information, checking, recording, localizing, restoring, signaling, erasing, and technical-econometric processing of record-keeping data.

The control facilities are the resources of the computing system (network) totally or partly dedicated to handling tasks of controlling information quality. All

facilities are divided into the following classes: hardware, software, organizational, legislative, moral-ethical.

The final structural component of the concept is the system for controlling the quality of information, which is defined as the organizational aggregate of facilities, methods and means installed in the computing system (network) for handling a selected set of control tasks.

A crucial component of the concept is the set of conditions whose observance will be conducive to enhancing efficacy of controlling information quality. These conditions act as feedback from the structural components of the concept to the more general concepts of setting up and using computing systems and networks.

The major general procedural conditions are recognition of the significance of the problem and existence of prerequisites for its solution. Recognition of the significance of the problem is understood to mean not just acknowledgment of the need for controlling the quality of information in computing systems and networks, but the need for precisely the systems-concept approach. The existence of prerequisites means availability of a well-structured and generally recognized concept of controlling information quality, adequately developed and validated management methods and models of a perfected arsenal of control facilities, a complete set of guidelines and procedural materials, and an adequate staff of skilled specialists on control of information quality.

The next class of conditions is made up of two groups: structural-functional uniqueness of the components of the system (network), and organizational unity of management.

The last class of conditions are so-called structural conditions, i. e., conditions that must be adhered to in the architecture (structure) of computing systems and networks. Three groups of conditions are distinguished in this class: conceptual standardization, structuredness of components, and degree of development of the infrastructure.

The given concept of controlling information quality is to be implemented in the Experimental Zone of the ArSSR Republic-Wide Network of Computing Centers that has been developed in accordance with a comprehensive goal-directed scientific research program.

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UDC 681.3.004.14.003.13.002.235

DEFINING FACTORS THAT ENHANCE EFFICACY OF ORGANIZATIONAL FORMS OF USING COMPUTER TECHNOLOGY

[Article by R. A. Mamedov, Institute of Cybernetics, AzSSR Academy of Sciences]

At the present time considerable attention is being given to global improvement of the entire mechanism of management, including improvement of the system of national economic planning. Of considerable importance for solution of this problem is continued development of the methods of accounting, analyzing and planning economic results of utilizing computer technology.

The performance of the automated control system in an enterprise and its handling of tasks in management of the production process is based on extensive use of computer facilities. The current status of utilizing computer technology in production management is typified by an increasing tendency toward emphasis of centralized processing of economic information in computing centers, multiple-user computing and data processing centers, and collective-use computing centers that are the main organizational form of utilization of this technology in enterprises, associations and ministries, and are also the central link, the technical base of the automated control system. They perform the major functions and ensure the efficiency of the automated control system. The computer functions on data processing in the automated control system may be performed on devices of a variety of types and designs. Economic feasibility of using computer facilities requires that their design, type, and especially the organizational form of using them must conform to the greatest degree to the specific conditions of the plant and the system that controls it. Different levels of one-time and running expenditures associated with setting up and operating the appropriate computer system alter the economic effectiveness of the automated control system, making it incumbent to use sound judgment in choosing hardware corresponding to the conditions of the most economic approach to tasks of the automated control system.

Production efficiency is influenced by numerous factors whose effect must be objectively evaluated and accounted for from the standpoint of production development. This predetermines a systems approach to analysis of the economic effect of implementing scientific-technical and organizational measures, and primarily establishing the growth of production efficiency for subsequent classification of factors. Various factors have been suggested in industrial-methods materials on planning, record-keeping and analysis of the results of production management. In some cases, a comprehensive factor of "introducing and using computer technology" is not singled out, while its introduction and use is an independent area of scientific and technical progress that should be characterized by data and economic planning indicators provided by the system of planning of economic and social development of the USSR.

While it is a comparatively recent factor in raising production efficiency, the introduction and use of computer technology has become a mandatory prerequisite of development of other factors. This should be taken into consideration when ascertaining the efficacy of introducing and using computer technology and its effect on the joint results of the production management activity of an

enterprise. And the most objective estimates of such influence can be obtained by determining the economic effect of introducing computer facilities from the systems viewpoint, taking into consideration that the effect is generated in conjunction with other simultaneously acting factors that produce the final economic results of operation of the enterprise. Therefore, the systems approach to analysis of the economic effect of introducing and using computer technology, determination of its quantitative planned and actual values during different periods of operation of the enterprise, are of particular importance for solving the problem of ascertainment and most complete utilization of factors and sources of intensification of production and enhancement of efficiency. The economic effect of implementing the entire set of factors that enhance production efficiency as a systems approach is always greater than the sum of its parts that are formed under the action of separate factors. However, this does not mean that it is impossible to treat such an effect as the aggregate of additive components when certain conditions are adhered to.

Thus, particular attention should be given to analyzing the aggregate of additive components of factors of the comprehensive factor of introducing and using computer technology. Among these factors are the development and introduction of all types and levels of automated control systems for all purposes, and the efficacy of operation of computing centers as organizational forms of utilizing computer technology.

To develop proposals on enhancing the operating efficiency of computing centers, a certain methodology must be used in which the starting element has to be classification of the reserves for growth and steps for enhancing the operating efficiency of computing centers to ensure unity of the methodological approach when analyzing the efficiency of computing centers and developing proposals for enhancing this efficiency.

Principally, analysis of the efficiency of operation of computing centers should enable evaluation of the extent to which computing centers meet the current needs of subscribers for doing computer information tasks; the extent to which these centers will be able to meet the needs of subscribers for doing such tasks in the foreseeable future; the extent to which use is being made of computer technology and computing centers.

Data on the needs of subscribers and the capabilities of computing centers that are necessary for analysis should be obtained mainly on the basis of charting, questionnaires and statistical accounting. A survey is being made of both computing centers and subscribers, i. e., the enterprises and organizations that are served by the computing centers, and the organizations of ministries (agencies) in which there are no computing centers, but computer equipment for doing computer information tasks is either on hand, or plans have been made to obtain it.

Systematization and generalization of the results of the survey is the first stage of analyzing the effectiveness of computing centers. The second stage is development of steps for enhancing the effectiveness of computing centers. These steps must ensure efficient distribution of the computational resources of computers within the framework of enterprises, associations, ministries (agencies) and sectors, and improvement of the organization of utilizing the computing equipment

in the computing center (with the required degree of centralization of operational control of the computing center), including development of multiple-user and collective-user computing centers and networks of computing centers.

The steps should be selected with consideration of the expenditures of resources on implementing them. A set of steps may be considered advisable that will enable the use of reserves for increasing the efficiency on the scale of the ministry (agency) and sector with the minimum possible expenditure of resources. In doing so, consideration must be taken of the conformity of projected characteristics of computing centers and networks to the needs of subscribers. In the scope of the aforementioned methodology, global techniques must be developed for evaluating resource expenditures associated with supplemental outfitting and revamping computing centers, setting up multiple-user computing and data processing centers, collective-user computing centers and networks of computing centers. Special analysis must be done to evaluate possible steps for enhancing the effectiveness of computing centers involving the creation of networks of computing centers and intersectoral base collective-user computing centers.

Research results have shown that the individual factors of enhancing the operating efficiency of computing centers can be grouped into combined factors: additional loading of a computing center with the tasks of subscribers to the point of complete utilization of the capabilities of its computing equipment; development and introduction of mainly highly efficacious subsystems and tasks; improving the organization of computing center operation; developing interaction of computing centers with clients; improving the material and technical support of computing centers; setting up multiple-user computing and data processing centers to serve subscribers in a sector in accordance with their needs; eliminating isolated computing centers and connecting subscribers to the multiple-user computing and data processing center of the sector; setting up multiple-user or other computer information networks of computing centers; setting up intersectoral base collective-user computing centers. The effectiveness of computing centers is being analyzed on the basis of methods and means of factor analysis, as well as heuristic programming. Comparatively objective estimates of the effectiveness of introducing and utilizing computer technology can be obtained by comprehensive analysis of the "production efficiency - automated control system efficiency - computing center efficiency" system, including analysis of the mutual influence of factors in the components of this chain as a single research object.

Until recently, research has been prevalent dealing with automation of the first stage of analyzing computing center efficiency, and only by using techniques of artificial intelligence has it been possible to proceed to solution of problems of automating the second stage -- automatic analysis and interpretation of the results of investigation of the efficiency of computing centers with logical outputs and inductive-deductive structures. Expert systems include both these stages and are an example of the application of artificial intelligence techniques in areas where mathematical economics models are ineffective. Implementation of such a system will considerably enhance the efficiency and quality of processing of keeping records, planning, forecasting and management, thanks to automation of the mental work of specializing experts (including planners) in decision making.

The purpose of this work is to set up a system that will subsume the totality of formal and heuristic knowledge relating to the efficiency of social production, the development and utilization of automated control systems, computer technology and computing centers, the use of the resultant knowledge in solving problems of enhancing the efficiency of organizational forms of utilizing computer technology, and as a consequence, its manifestation in the summaries of production management activity of enterprises, ministries and sectors. The Institute of Cybernetics, AzSSR Academy of Sciences, has now set up part of a system that enables preselection of measures for enhancing the efficiency of computing centers. Complete implementation of the system will provide a powerful tool for evaluating the efficiency of all types and levels of automated control systems and computing centers for all purposes in their occurrence and influence on economic effectiveness of production, including qualitative and quantitative methods of determining the direct and indirect effect of computing center operation, and enabling these results to be compared with the summaries of activity of the computing center as a cost-accounting enterprise.

UDC 002:681.3:658.3-057.17.012.12

DEVELOPMENT OF SOFTWARE FOR A SYSTEM OF COMPUTERIZED DIAGNOSIS OF THE PERSONALITY QUALITIES OF ADMINISTRATIVE WORKERS (AS A TOPIC FOR DISCUSSION)

[Article by D. S. Petrosyan, Main Computing Center, Gossnab SSSR, and L. V. Fatkin, Moscow Institute of the National Economy imeni G. V. Plekhanov]

Organization of efficient work with administrative business personnel depends in large measure on the availability of objective evaluations of personality qualities. The best known method of evaluating the personality qualities of workers in administration is the approach based on formation of quantitative estimates of qualities by competent persons (experts). The main failure that restricts the use of this method is the subjectivity of expert evaluations. For this reason, methods of evaluating personality qualities based on using psychodiagnostic procedures are becoming increasingly population in management theory.

The content of methods of psychodiagnostic procedures consists in analysis of the information of responses of the workers being evaluated to specially compiled control questionnaires, and using them as the basis for getting quantitative grades of the degree of development of certain personality qualities. The use of modern computer facilities is called for because of the large body of initial data on responses of the workers being evaluated, the need for gathering, checking, processing, transforming and storing this information, and the difficulty of calculating the grades of personality qualities.

The main problems in developing software for a system of computerized diagnosis of the personality qualities of workers in management are:

setting up a normative reference base for diagnosing personality properties;

organizing the gathering and checking of information on responses of the workers being evaluated to the questionnaires;

calculating the resultant evaluations of personality qualities;

generating and outputting computer charts (videograms).

It is proposed that the normative reference base for diagnosing personality qualities include instructive materials for filling out the control questionnaires, reference information tables designed for calculating the evaluations of personality qualities, and lists of the personality qualities to be evaluated.

It is advisable to gather the responses to the questionnaires by using a system of displays that allow simultaneous completion of questionnaires by a certain group of workers being evaluated. First the screen displays the text of the general instructions on work with the questionnaires. After reading this, the person being evaluated inputs to computer storage his personal data (name, date of birth, employer, job description, and so on) by typing them into appropriate fields on the display screen.

Then the screen present brief instructions on performing the first control assignment, followed by the questions of the assignment, each of which has a multiple choice of responses. Given below is a fragment of a control assignment:

<u>Assignment No 1</u>

Read the questions carefully, and select one response form the choices offered.

001. Do you consider yourself a demanding supervisor?

1. yes -- 1; 2. probably so -- Ø; 3. don't know -- Ø; 4. probably not -- Ø; 5. no -- Ø.

002. Are you disappointed when your classmates or workers with less seniority advance faster than you do?

1. yes -- Ø; 2-- probably so -- 1; 3. don't know -- Ø; 4. probably not -- Ø; 5. no -- Ø.

The worker chooses a response by typing a "1" in the field on the screen that corresponds to the selected choice.

As the information on responses is input, it is logically checked both with respect to conformance with the rules of doing the control assignments, and also for adequacy of information processing on the computer. In case of failure to pass the logical check, the information is not put into computer storage, and a message appears on the screen of the display indicating the the response contains an error that must be corrected. This precludes response to the next question of the assignment, processing of the corresponding information and recording in computer storage.

As a result of input and checking of initial information, a file of M numbers of responses to the questions of the control assignments is formed.

File M is described by sets m^r

$$m^r = \{m^r_{ti}\},$$

where m^r is the set of numbers of the selected responses to questions of control assignments by the r-th worker; m^r_{ti} is the multiple-choice number of the answer to selected by the r-th worker to the i-th question of the t-th control assignment.

Calculation of the values of grades of the personality qualities of the worker is done on the basis of the file and a reference information table in which every personality quality k is put into correspondence with a set V^k of weights of the choices of responses to specific assignments that are required for determining the grade of the k-th quality. Set V^k is described by the following expression:

$$V^k = \{V^k m_{ti}\},$$

where Vm^k_{ti} is the weight of the m_{ti}-th multiple-choice answer of the i-th question of the t-th control assignment for calculating the grade of the k-th personality quality.

The quantity Vm^k_{ti} takes on integer values ranging from 0 to 5. At $Vm^k_{ti} = 0$, the m_{ti}-th response to the i-th question of the t-th control assignment is considered insignificant for calculating the grade for the k-th personality quality.

The value of the grade O^{rk} of the k-th personality quality for the r-th worker is determined by the formula

$$O^{rk} = \sum_{i \in k} \sum_{m_{ti} \in m^r} V^k m_{ti}.$$

The value $i \varepsilon k$ is established from the reference information table.

It is proposed that the set of personality qualities to be evaluated should be based on qualities that typify readiness of the worker for administrative work (adaptation mobility, emotional leadership, capability for integrating social functions, maintaining close contact, stability under stress, general intelligence level, qualities of determination and so on).

The next stage is standardization of personality qualities, i. e., putting their calculated values into correspondence with a unified scale. To do this, a special conversion table is used in which each grade by the standard scale is put into correspondence with some range of grades by the scale for calculation of grade O^{rk}.

The resultant standardized grades O^{rk}_{st} are formed as a resultant file of evaluations of the personality qualities of workers $O_{st} = \{O^{rk}_{st}\}$, on the basis of which

the output computer charts (videograms) are generated. Video charts are output at the request of the user of the diagnostic system, who has the capability of getting information about a specific worker, or about some group of workers who have a prescribed range of evaluations of personality qualities.

The headline of the computer chart gives the personal data on the worker, and a table on each quality gives the name of the quality, the grade O_{st}^{rk}, and the values of the upper and lower limit of the range of positive evaluations. In case of necessity, the symbol * denotes an grade for qualities that have a negative degree of development, i. e., do not fall into the range of positive evaluations. Part of a computer chart on grade of personality qualities of administrative workers is given below (the numbers are arbitrary).

		Range of positive grades		
Personality quality	Grade	Upper limit	Lower limit	Comment
Self evaluation	8	5	7	*
Level of general culture	9	5	10	
Self control	4	6	10	*
Maintaining contact	8	5	10	
Leadership	8	6	10	

Lists of personality qualities are used for decoding and output of the names of personality qualities in the computer chart, and for determining the range of positive values of grades.

The aforementioned principles have been the basis for a preliminary project on diagnosing personality qualities of administrative workers using an SM-4 computer developed at the department of management of the national economy at Moscow Institute of the National Economy imeni G. V. Plekahnov. This system is designed for evaluating personality qualities of students the department of skill advancement as part of a course on "Sociopsychological Aspects of Management." The system incorporates 12 control assignments containing about 500 questions, and gives grades on 40 personality qualities of administrative workers.

The system of computerized diagnosis of personality qualities of administrative workers may be recommended for incorporation as an individual module in the automated personnel control systems of enterprises and organizations in national economic sectors.

II. DEVELOPING AND INTRODUCING CLASSIFIERS AND THE UNIFIED SYSTEM OF DOCUMENTATION

UDC 025.4.002.235:658.3

IMPROVEMENT OF THE SOVIET-WIDE CLASSIFIER OF WORKING TRADES, PROFESSIONAL POSITIONS AND WAGE CATEGORIES (AS A TOPIC FOR DISCUSSION)

[Article by M. M. Eyzriker, candidate of economic sciences, and M. M. Akhtyamov, candidate of technical sciences, Scientific Research Institute of the Central Statistical Administration of the USSR]

The Soviet-Wide Classifier of Working Trades, Professional Positions and Wage Categories (OKPDTR) was approved by Gosstandart in 1975 and put into effect in 1976. During its tenure, a number of amendments have been made to the classifier.

However, a number of problems are encountered when introducing the OKPDTR in the system of the Central Statistical Administration of the USSR, especially when incorporating the classifier into forms of once-only registration of the numbers of workers by trades in industry. The classifier has been developed on the basis of issues of the Unified Wage and Skill Reference for Jobs and Trades of Working People (YeTKS) and is an alphabetized list of working trades and professional positions. Five facets are distinguished in the information block of the classifier of working trades: "Types of Industries and Jobs," "Wage Categories," "Classes (Categories) of Skills," "Wage Forms and Systems," and "Working Conditions." In accordance with a proposal of the Central Statistical Administration of the USSR, two more facets were added in 1983: "Degree of Mechanization of Labor" and "Basic and Ancillary Workers."

However, the OKPDTR does not allow working trades to be grouped by some features that are used in statistics. Therefore the OKPDTR classification and coding system needs further revision.

Presented herewith are proposals for amending the OKPDTR based on analysis of the content of forms of once-only registration of the numbers of workers by trades in industry, as well as certain other forms of statistical accounting.

In accordance with the program of once-only registration carried out by agencies of the Central Statistical Administration of the USSR, several dozen forms are used for statistical reports. For the purpose of analysis, a selection was made of ten reports dealing with numbers of workers by trades, wage categories, wage forms and systems in enterprises of a number of industrial sectors: electric power, gas, nonferrous metallurgy, chemistry, machine building, processing of wood, pulp and paper, building materials, light industry and food.

Control coding in accordance with OKPDTR of positions of the third division of a number of forms for "Numbers of Workers and Apprentices by Trades as of 1 August 1982" revealed that each of the forms contains positions that cannot be encoded by codes of this classifier.

In order to develop proposals for amending the OKPDTR, analytical tables were prepared for correspondence of the titles of groups of working trades in accordance with each form to the titles of working trades in the OKPDTR. The following fragment shows the appearance of part of a table exemplified by form No 2 of the paper industry: "Report of Enterprise of the Paper and Pulp Industry on Numbers of Workers by Trades, Wage Categories, and Wage Forms and Systems."

Line code in form	Name of trade, group in form	Codes corresponding to trade according to OKPDTR	Names of trade in OKPDTR	Codes of YeTKS issues
007	Machine operators in the paper and pulp industry	10605	Machine operator preparing aluminum sulfate	41
		10856	Machine operator of turpentine unit	41
		10945	Fiber-drawing machine operator	41
292	Emulsion workers	-	-	-

Analysis of the analytical tables showed that all titles of the positions contained in forms of registration of the numbers of workers by trades can be divided into a few types:

positions with titles that do not occur in the OKPDTR;

generalizing positions (groups) that cannot be encoded by OKPDTR codes;

positions in which the titles of the working trade in the form do not coincide with the title of a working trade in the classifier.

In order to eliminate these deficiencies, it is necessary to define the classification groups of working trades and professional positions that are used in doing tasks in the automated control system, including in the Automated System of State Statistics, and to make the corresponding changes in the OKPDTR.

The first and second divisions of the existing classifier can be incorporated into the OKPDTR as an alphabetized list of working trades and professional positions.

It would be advisable to supplement the existing classifier with third and fourth divisions: "Groups of Working Trades" and "Groups of Professional Positions."

The following structure is proposed for the classifier object code:

```
  x          xxxx          x
  |            |           |
  |            |           |Control
  |            |           |digit
  |            |Ordinal number
  |            |of object
  |Working trade
  |Working trade group
  |Professional position
  |Professional position group
```

In the division "Groups of Working Trades," an alphabetized list is given of the titles of trade groups, an example of which is presented below:

Code of working trade group title	Working trades
30001	Metalworking machine operators
3003	Machine operators in the paper and pulp industry
30055	Dumptruck drivers

In the division "Groups of Professional Positions," based on analysis of the annual reports of collective and state farms and other agricultural enterprises, an alphabetized list of group titles is proposed. An example of the division is presented below:

Code of professional position group title	Professional positions
40010	Engineering and technical personnel
40011	Junior service personnel
40017	Accounting workers in teams and on farms

Implementation of the proposals on improving the OKPDTR will accelerate its introduction into the practical work of state statistical agencies.

UDC 025.4:669.2/.8-41/-42

SETTING UP AN ASSORTMENT SECTION OF THE SOVIET-WIDE CLASSIFIER ON NONFERROUS METAL ROLLED GOODS IN A TEN-DIGIT STRUCTURE

[Article by S. N. Konovalova, V. V. Gvosdeva, GNITsVOK (not further identified), Yu. M. Leybov, candidate of technical sciences, and G. A. Busalova, State Design and Planning Scientific Research Institute for the Processing of Nonferrous Metals]

Nonferrous metal rolled goods subsumes a long list of products, requiring a considerable number of identification features to define a specific item of delivery, such as the grade of metal or alloy, method and precision of fabrication, and delivery status. Because of the wide range of products, it is a rather complicated matter to reflect all necessary characteristics when classifying and coding these goods in class 18 of the Soviet-Wide Classifier.

With consideration of all required features, a block structure has been worked out for classification and coding of nonferrous metal rolled goods that has been confirmed for use as a temporary structure in blocks of: grades, metals and alloys, group product list, forms and conditions of shipment.

The overall length of the code of basic classification features necessary for formulating orders for nonferrous metal rolled goods in the block structure is 16 characters (instead of the ten characters accepted in the OKP), causing considerable difficulty when using the codes of nonferrous metal rolled goods in documents for product certification, when providing information service at the requests of other sectors, and in various other documents. In this connection it is necessary to compile a classifier for nonferrous metal rolled goods in a ten-digit structure. With consideration of the specifics of producing and distributing the goods, basic principles have been proposed and developed for constructing such a classifier.

Nonferrous metal rolled goods are identified within the scope of the corresponding group of the OKP and the grade of metal or alloy based on the block system of classification and coding of class 18 of the OKP.

Within the limits of the selected grade, it is necessary to code combinations of dimensional and technical characteristics by a serial-ordinal method with differentiation of a series of codes for standards and technical specifications.

To validate the suitability of the basic principles of constructing a ten-digit classifier of nonferrous metal rolled goods, a fragment of the product list was selected for basic kinds of rolled goods: copper tubing grade M 1 (500 items), brass tape grade L 63 (about 300 items), and nickel band (100 items).

An experimental verification of the fragment, done while carrying out tasks of order registration and formulation of deliveries of nonferrous metal rolled goods, calculation of the production plan, loading of equipment, major technical-economic indicators and a number of other tasks of interaction of the ferrous metals subsystem of the automated management system of Gossnab SSSR and the sector-wide automated management system of the USSR Ministry of Ferrous Metals, required refinement and improvement of the previously proposed principles of setting up the full-range section of nonferrous metal rolled goods in the ten-digit structure of the OKP on the 8-th, 9-th and 10-th places of the code.

In addition, in order to carry out jobs of specializing the plants of the ferrous metallurgy industry, it was necessary to refine the method of formulating the full range regulated by specific standards and technical specifications by allocating series of codes within the scope of all grades of metals and alloys and forms of rolled goods.

The initial proposal was to allocate series of codes for the full range incorporated into the defined standard independently for each specific grade of metal or alloy. For another grade of full range of the same standard, some other series of codes might be allocated in another classification grouping.

As a result of refinement of procedural principles, it is proposed that series of codes be formulated for encoding the product list provided by a certain standard or technical specifications for rolled goods of all kinds and grades in the same allocated series of codes, even in the case where they are incorporated into different classification groupings (K-OKP).

For example, State Standard GOST 6235-73 provides for production nickel sheets and strips in grades NP-2, NP-3 and NP-4. The sheets are incorporated into grouping 18 4210 of K-OKP, and strips -- into grouping 18 4220. It is proposed that the series from 200 to 250 in the 8-th, 9-th and 10-th places of the code be allocated in both groupings in all three grades of the product list regulated by GOST 6235-73.

This kind of coding of the product list of nonferrous metal rolled stock will ensure unique consignment of orders by plants with the use of computer technology.

In addition, the experimental verification demonstrated the feasibility of subdividing codes allocated for a specific product list of rolled goods, which had previously not been provided for.

Special code series must additionally be allocated in the product list code series for each category of manufacturing precision: normal, moderate and high.

The proposed refinements implement by grouping of features are necessary for more complete description of the major characteristics of rolled goods in the standard or in technical specifications.

Experimental verification of the basic principles has enabled us to define directions for improving the technique of setting up the classification and coding of nonferrous metal rolled goods in the 10-digit structure of the OKP, to allow for the requirements of sectors of the national economy, and to begin development of a classifier in 10-digit structure.

UDC 025.4:002:31(047)

SECTOR-WIDE DIVISION OF THE CLASSIFIER OF STATISTICAL ACCOUNTING DOCUMENTATION

[Article by V. A. Kudinov, candidate of economic sciences, Scientific Research Institute of the Central Statistical Administration of the USSR]

One of the classes of the Soviet-Wide Classifier of Administrative Documentation (OKUD) is the Unified System of Statistical Accounting Documentation (USOSD). According to GOST 6.12.1-75 "Unified System of Documentation. System of Statistical Accounting Documentation. Basic Principles," the makeup of the USOSD shall include forms of statistical accounting documentation presented by state statistical agencies. These forms have indeed found reflection in the OKUD. For purposes of systematization and identification of the totality of all forms of statistical accounting documentation, the Scientific Research Institute of the Central Statistical Administration of the USSR has developed a sector-wide division of the classifier of statistical accounting documentation (OR KOSD) incorporating the corresponding forms confirmed by the Central Statistical Administration of the USSR, but not presented to agencies of state statistics. In connection

with this, the order of coding of the aforementioned sector-wide forms established by "Instructions on Registration of Unified Forms of Documentation" (RDI 82-76) does not extend to these forms. Therefore in developing the OR KOSD, the principles of classification and coding of forms of statistical accounting documentation accepted in class 06 of the OKUD have basically been retained.

The OR KOSD uses the hierarchical and facet methods of classification. The hierarchical method is realized in the following way. On the first stage the classification tag is "sector of statistics." With respect to the OKUD this is the fourth stage, and with respect to the system of statistical accounting documentation it is the third stage of classification (on the first stage, administrative documentation is divided into classes, on the second stage, statistical accounting documentation is subdivided into Soviet-wide documentation confirmed by the Central Statistical Administration of the USSR and republic-wide information confirmed by the central statistical administrations of Soviet republics, and on the third stage, the documentation confirmed by the Central Statistical Administration of the USSR is subdivided into documentation that is and is not presented to agencies of state statistics). With respect to this tag, the forms of statistical accounting documentation are subdivided in accordance with the types of activity reflected by them into groups (by sectors of statistics) (see table below). As a rule, the groups are arranged by divisions with makeup specific to each sector of statistics. For example, the divisions "Supply Statistics" and "Sales Statistics" are singled out in the sector "Statistics of Material-Technical Supply and Sales," the divisions "Statistics of Wholesale Trade" and "Statistics of Retail Trade" are set apart in the sector of "Trade Statistics," and so on.

Sector of statistics	Values of third and fourth digits of code
Statistics of finances, prices, credit and state insurance	23
Statistics of labor and wages	24
Statistics of technical progress	25
Statistics of industry	26
Statistics of agriculture	27
Statistics of capital construction	28
Statistics of material-technical supply and sales	29
Statistics of trade	30
statistics of transportation and communications	31
Statistics of public housing and daily services	32
Statistics of culture and science	33
Statistics of population, public health and social welfare	34
Statistics of natural resources and the environment	36
Statistics of outside communications	37
Statistics of administrative agencies	38
Statistics of party and social organizations	39

On the next stage of classification, the forms of statistical accounting documentation are subdivided in accordance with the principle "Purpose of Statistical Accounting Documentation" into intersectoral (interagency) and sector-wide (agency-wide) forms. The intersectoral (interagency) forms include those that contain general indices for the activity characteristic of the enterprises and organizations of all or some ministries and agencies. Sector-wide (agency-wide) forms of forms are intended for individual ministries, agencies, enterprises, agencies and organizations. An example of an interagency form may be form 1-k "Report on the Numbers, Composition and Movement of Workers Employed as Supervisors and Specialists" that is used in reports by enterprises and organizations of ministries and agencies, while form 2-t (brigade) of the Ministry of Railroads "Report on the Numbers of Workers Covered by the Brigade Form of Organization and Work Incentive, Presence and Certification of Work Stations" is agency-wide, as it is effective only in the given system.

On the last stage of classification, the sector-wide (agency-wide) forms of statistical accounting documentation are arranged by ministries and agencies with enterprises and organizations that differ with respect to these forms.

Facet classification in the OR KOSD, just as in class 06 of the OKUD, is done in accordance with the principles "Method of Presentation," "Periodicity of Presentation" and "Time of Retention."

The method of division identification and classification is used in coding. The code of a form consists of blocks of identification and classification tags. A combination of sequential and series-ordinal coding is used within the limits of the identification code. The length of the identification code is seven characters (the eighth character is a control bit).

Just as in the OKUD, the first two characters have the value 06, indicating that the form belongs to the system of statistical accounting documentation. The third and fourth characters (within the limits of the number series 20-59) denote that the forms belong to the sector-wide division of KOSD (forms confirmed by the Central Statistical Administration of the USSR and presented by agencies of state statistics, i. e., that are part of the OKUD, are coded in the range of series 01-19, while forms confirmed by the central statistical administrations of the Soviet republics are coded in the range of series 61-75). The specific numbers of this series code forms that apply to a certain sector of statistics.

The next three characters of the identification code are the registration number of the form of the document in the sector of statistics. Series of numbers are set aside here with regard to the necessary reserve for coding forms relating to certain divisions of sectors of statistics, in each series, subseries of numbers are allocated for coding intersectoral (interagency) and sector-wide (agency-wide) forms, and within the subseries allocated for coding agency-wide forms, groups of numbers are assigned for individual ministries and agencies. The volume of the series, subseries and groups in sectors of statistics is different and depends on the number of divisions allocated in each sector of statistics, the number of ministries (agencies) that have sector-wide (agency-wide) forms, and also on the number of forms that go to make up each classification grouping. For example, in the sector "Statistics of Finances, Prices, Credit and State Insurance," forms

pertaining to the division "Statistics of Finances" are coded by the series of numbers 001-199, those pertaining to the division "Statistics of Prices" are coded by the series 200-299, and those pertaining to the division "Statistics of Credit and State Insurance" are coded by the series 300-499; in the division "Statistics of Finances," intersectoral (interagency) forms are coded by the subseries 001-049, while the subseries 50-199 that codes sector-wide (agency-wide) forms is subdivided into groups that are assigned to individual ministries.

The classification block of the code, just as in class 06 of the OKUD, includes a two-place code of periodicity (frequency) of presentation, and one-place codes of the method of presentation and the retention time. The values of the codes are analogous to those given in the introduction to OKUD.

UDC 025.4:677.076

DEVELOPMENT OF SECTOR-WIDE CLASSIFIER OF CHARACTERISTICS OF INDUSTRIAL FABRIC GOODS

[Article by I. S. Davydova, candidate of technical sciences, and R. I. Varavka, Candidate of technical sciences, All-Union Scientific Research Institute of Industrial Fabrics, Yaroslavl]

Experience in developing and introducing sector-wide divisions of the Soviet-Wide Classifier of Industrial and Agricultural Products (OKP) has shown that they do not support all tasks of automated management systems (in particular, price formation tasks), as they have limited capability of reflecting the necessary classification tags of goods in the OKP decimal code. Therefore the OKP code is used as an identifier, as a language intermediary between the automated management systems of different areas and levels.

In addition, the OKP contains a large percentage (up to 30 percent for some divisions) of "null" groups, i. e., groups that do not coincide with a fundamental aspect of the OKP classification. To disclose the content of these groups, data-gathering algorithms have to be compiled that make it difficult to solve the formulated problem.

At the present time there are quite a few local classifiers of goods that have been developed for handling specific tasks of automated control systems. This leads to duplication of effort on setting up classifiers, and to incapability of comparing information with respect to levels of management.

To eliminate the aforementioned deficiencies and ensure introduction of the OKP into automated management systems of all levels in light industry, it has become necessary to develop a sector-wide goods classifier (OtKP) that will ensure unmediated (direct) coding of any characteristic that may be needed in data processing.

The All-Union Scientific Research Institute of Industrial Fabrics (Yaroslavl) has developed a sector-wide classifier of characteristics of goods for groups 8191 "Goods of the Textile Industry (Except for Fabrics, Nonwoven Materials and Knitted Items)," 8218 "Heavy Cotton Industrial Fabrics" and 8318 "Ready-Made Cotton

Industrial Fabrics." The facet system of classification and coding was used in developing the OtKP. The characteristics of goods in the OtKP were selected with consideration of their significance for problems of processing, storage and retrieval of technical-economic information in automated management systems.

TABLE 1

List of facets (features) in subclass 819

Code	Facets	OKP code	Definition
00	Systematic list of groupings and species of goods		
01	Ply number	81 91xn	Gradation of textile materials (straps, belts, filtering elements) depending on the warp (ply) number
02	Purpose	-	Purpose of textile materials (straps, belts, filtering elements) used in various sectors of industry
03	Raw material	81 91 n x 81 91xxnnx	Types of fibers used in items of commercial purpose
04	Article	81 91xxnnx	Conventional numerically expressed designation of goods
05	Finish	81 91xxnxx x	Imparting commercial outward appearance to textile materials (straps, belts, filtering elements)
06	Grade		Arbitrary designation of species of goods

Note: n--location and signficance of feature in OKP facet code;
x--digit configuration of facet

To form the main facets with respect to subgroups 8191 and 8318, the characteristics indicated in tables 1 and 2 were chosen. The features were allocated by the principle of comparability of goods, the feasibility of amalgamation in data processing tasking, as well as retrieval in tasks of reference information servicing.

The basic (null) facet 00 "Systematic List of Groupings and Species of Goods" unifies all facets into an integral system. The species were specific forms of items taken from the A-OKP [not further identified].

Each position of the list has a corresponding facet formula, i. e., a fixed sequence of facets (classification features by which parallel division is effected on the groupings and species of goods described by the facet formula).

Setting up the OtKP will:

provide for a changeover conjointly with the OKP from software-incompatible local classifiers to a unified and well-ordered system of classification and coding of goods of light industry;

make it feasible to set up a unified sector-wide databank on goods based on certification of items of light industry;

TABLE 2

List of facets (features) in subclass 831

Code	Facets	OKP code	Definition
00	Systematic list of groupings and species of goods		
01	Purpose	83 18nx xxxx	Purpose of fabrics used in different sectors (rubberized cloth, tires, light industry and so on)
02	Grades of fabrics	-	Conventional designation of species of goods
03	End purpose	83 18xx nxxx	Specific purpose of fabrics used in different sectors of industry (for conveyor belts and flat V-belts, for rubber gloves, for tires)
04	Weave	-	Means of altering and varieties of pattern and outward appearance of fabrics
05	Cloth article	-	Conventional numerically expressed designation of goods
06	Completed finish	83 18xnxxxx	Imparting commercial outward appearance to fabrics by spraying, heat treatment and so on
07	Kind of storage	83 18xx xxxn	Depends on facilities of packing and storage
08	Rating of fabrics	-	Gradation of fabrics by quality indices as established by normative documentation

reduce effort and shorten development time in jobs of planning, accounting, statistics, price formation and the like;

create reference retrieval machinery for managing sector-wide divisions of OKP and OKP SEV {not further identified].

In this way we will ensure enhancement of the efficiency of operation of automated management systems of various levels in light industry.

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CSO: 1863/328

UDC 658.012.011.56

MICROPROCESSOR BASED ASUTP

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 3, Mar 86 p 16

[Article by Ye.G. Osipov, SPKB [specialized planning and design bureau] "Promavtomatika"]

[Text] For the first time in the domestic practice of natural gas production, microprocessor devices have been implemented, which make it possible to receive process information, process data, form situation reports, control distribution of loads between technological streams and automatically transmit information to upper-level computers. Implementation of ASUTP [automated system for the control of technological processes], that use microprocessors, at UKPG-1AS and UKPG-2V [unit for complex gas treatment] at the Urengoy gas field has saved 2.7 million R annulally.

For the collective of SPKB "Promavtomatika", that works on developing special equipment for automated control of technological processes of gas production and pretransportation gas treatment, the last year has been marked by the implementation of two different microprocessor based ASUTP at the Urengoy gas field. A computer control complex (UVK), based on "Elektronika-60" microcomputers, forms the technical foundation of both ASUTP and can be manufactured in various modifications. The complete set (installed at UKPG-1AS of the Urengoy gas field) is a two-machine complex, that includes an "Elektronika-60" microcomputer, a 15VUMS-28-025, a control console with digital display of controlled parameters, an information display panel (a mimic panel) and a set of cabinets and racks, that make it possible to convert received signals for input into a computer, perform the output of control actions to operating mechanisms, realize functions of emergency protection of the equipment. The complex is made on the basis of unified UTK constructives. The Krasnodar experimental plant of SPKB "Promavtomatika" has mastered manufacturing of UVK.

The experience in the development and implementation of ASUTP at UKPG-2V of the Urengoy field has demonstrated, that it is possible to build a system, using a simplified UVK, that has only one "Elektronika-60" microcomputer. The ASUTP software can be simplified accordingly. However, one would be able to draw a final conclusion as to the feasibility and the degree of such simplification only as a result of accumulating operating experience (for at

least a year) and comparing the two different ASUTP.

For a two-machine UVK, SPKB "Promavtomatika" has developed an original operating system, that supports the operation of the complex in an automated mode and in the dialogue-with-the-operator mode and makes it possible to solve necessary problems.

Software for automated generation of software for ASUTP, that are being implemented at similar UKPG, has been developed.

The distinguishing feature of ASUTP UKPG with absorption dehydration is the ability to solve process control problems, using the results of indirect calculations of values of parameters (glycol concentration after regeneration, humidity of dehydrated gas), direct measurement of which does not seem possible.

Along with control functions, traditional problems are also being solved:

measuring on request, on-line display and recording of values of technological parameters and indices, that characterize the condition of UKPG equipment;

detecting and signalling deviations of values of technological parameters and indices, that characterize equipment condition, from specified limits;

control, on-line display and signalling of triggering of interlocks and protections;

calculation of technical, economical and operational indices of UKPG functioning;

protection, interlocking and remote control of UKPG technological equipment;

information preparation and transmission to the upper management level (gas field ASUTP) and retranslation to the upper level of information on operation of remotely controlled wells TM [remote control] - gas.

The system also performs ancillary functions, that support solving intrasystem problems (hardware functioning, hardware condition and information storage control etc).

Design solutions of ASUTP UKPG with low-temperature separation (NTS) are based on the principle of stabilizing instantaneous gas consumption in technological streams with the help of an adjustment union, installed at the inlet of a low-temperature separator.

This makes it possible to simplify the control algorithms and solve a number of new problems on diagnosing equipment condition, controlling formation of hydrates in gathering lines of well clusters and in heat exchangers, and reducing methanol consumption.

Visual display of information on parameters deviation and recording all programs in PPZU [programmable memory unit, or semipermanent memory unit]

simplify operation of the system and make it possible for the operator to quickly orientate him- or herself in taking necessary steps, when unit's operating mode changes.

Implementation of ASUTP, that use microprocessors, at UKPG of the Urengoy gas field is but the first step in creating fully automated complexes for production of natural gas and condensate. But one should have a general understanding, that a controlling complex per se, no matter how dependable it is and how comprehensively it covers the direct and ancillary production at UKPG, might not be able to ensure an "operatorless technology". To achieve this goal, a number of organizational and technical measures have to be taken.

A real 20% reserve in productivity in construction and operation of gas fields must be provided. As a rule, this reserve can be only achieved after a gas field has been constructed, hence, until the construction has been fully completed, the "operatorless technology" is only realized at those UKPG, that have such reserve.

When there is reserve productivity, it is necessary to be able (in cases of emergency) to completely shut off a UKPG for the amount of time, necessary for repair crews to arrive. This time must be regulated, and repair crews must be provided with transportation means, modified for the natural conditions of the region.

Reliable telephone or radio communications between UKPG and the central dispatching station must be provided.

For UKPG, that operate without permanent service personnel on the premises, preventive maintenance is mandatory, and its frequency is determined by equipment reliability level.

Preventive maintenance of UVK must be performed without shutting off UKPG. During the period of UVK debugging, control of UKPG must be provided by stand-by equipment, turned on-site.

It is necessary to improve the reliability of processing equipment, so that its mean time between failures is not less than 1,000 h.

It is desirable to simplify gas treatment technology and reduce the amount of information, circulated between different management levels and at a UKPG itself.

It should be noted, that efforts on organizing watchless operation can only be successful, if it is possible to completely shut off a UKPG without hindering the meeting of plan quotas. It is possible, that, in order to implement this measure, it would be necessary to consider a case of compensating losses in gas production in gas fields, that use "operatorless technology", at the expense of those gas fields, that are operated by service personnel.

12770
CSO: 1863/335

EDUCATION

'IRISHA' PERSONAL COMPUTER

Moscow TEKHNIKA I NAUKA in Russian No 6, Jun 86 pp 33-35

[Article by S. Ryabchuk, engineer: "The 'Irisha' for Irisha"]

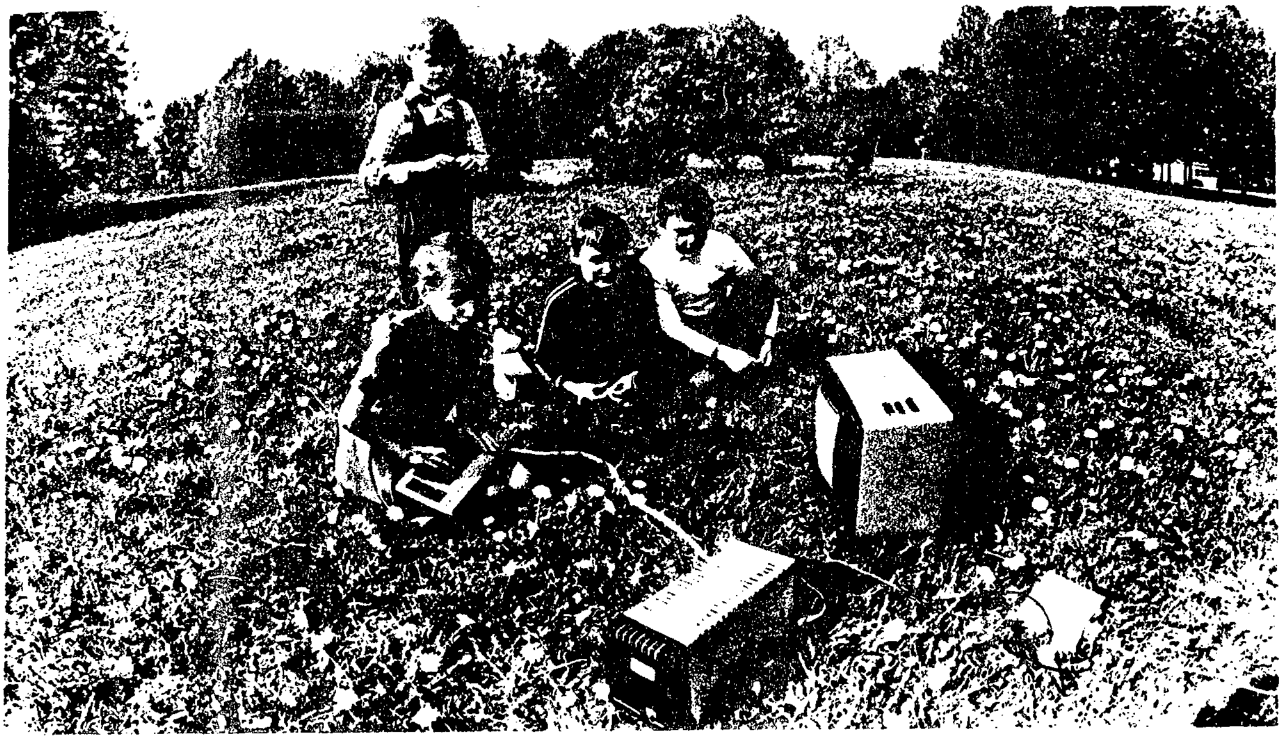
[Text] The "Irisha" personal computer, software-compatible with many existing machines, has been developed and brought to the level of experimental models by workers at the Institute of Information Problems, USSR Academy of Sciences, and members of the chemistry department at Moscow State University imeni M. V. Lomonosov. It is simple to operate and accessible to children in grammar school. It can be interfaced with off-the-shelf color and black-and-white television sets, and with cassette tape recorders. The microcomputer consists of three boards designed around readily available chips, and can be produced in a short period by base enterprises for patronage schools and vocational academies.

The year 1985 marked the beginning of popular instruction in computer fundamentals. A grammar school course on "Principles of Information Science" was introduced for the first time. This was done to give school children an idea about what today's computers are, to teach them to understand the capabilities of computers, not to be afraid of them, to use them in work and in learning.

Today, mass education in working with personal computers is being called "secondary literacy." This means that learning to work on personal computers will usher in a revolution in processing and using information on a par with the invention of movable type in the fifteenth century.

Ideally, on should learn to work on the machine at the computer console. But for the present, the study of information science in schools will be a "dry run," i. e., without direct communication with the computer. The costs of such instruction are readily foreseen. Instead of putting the children to work on a new and live discipline, they will be given one more division of mathematics. And it cannot be ruled out that this may make them afraid of computers.

What is one to do? Decline to study a new subject? No, learning must begin, as otherwise the school will be totally divorced from present-day industry. There is only one way out: to provide schools and industrial education combines with minicomputers as quickly as possible. And a lot of them will be needed. Academician A. Yershov, an eminent specialist on grade-level information sciences and the author of a new textbook, writes: "More than a million personal computers will have to be introduced in the field of education, and in future this number will have to be considerably increased."



Why Microcomputers in Particular?

To answer this question, we need to recall a little bit about what a personal computer is, and how it differs from the now familiar large machines.

The personal computer, or the personal microcomputer, is a computing machine of great capabilities. Its operation does not require software. It is capable of interacting with a human operator. You type a program on the keyboard, and see the text on the display. Despite errors and lack of understanding, it is always ready to cooperate, to assist, to teach. It informs about a mistake that has been made, and prompts how the error is to be corrected. The personal computer draws pictures, makes graphs, produces audible and musical signals. Work with it is transformed into something like a game.

In a way, the computer is rather like the ultimate "Chatty Cathy Doll" with whom one can converse and play, that can figure, solve complicated problems, and teach the rudiments of writing and arithmetic.

What does it look like in reality? Before you stands a machine no larger than a typewriter. There is also a cassette tape recorder and a display (which may be an ordinary television set). That's all. Suppose that you have started to type the program, and you have made an error. The spot on the screen where this error has appeared begins to blink and swell in size. A synthesizer emits a beep. A disaster! But a prompt has appeared on the screen, telling you how to correct the error, you quickly type the proper word, and bingo! The error disappears, the beep dies away. The program has been corrected and you can move on.

Of course, this is a game that has been invented to teach beginners. And in order to instruct the machine on how to play, the programmers had to do a good deal of work to create the program concealed in the machine.

The developers of the computer V. Romanov (center) and B. Bystrov (right) discuss the feasibility of producing an experimental series of the machines with Academician A. Prokhorov, director of the Institute of General Physics, USSR Academy of Sciences

"Working by playing" is the new approach that has been formulated by the developers of today's computers. The game approach, the availability of convenient programs outwardly disguised as games, has been the age-old dream of the teacher. Therefore the principle of "learning by playing" can now be implemented by personal computers.

Computers and School Reform

The development of personal computers for school children is complicated by the added demands that are made on these machines. The school computer must be simple to control, and have easily replaceable modules. The cost of equipping a classroom should not exceed 25,000 rubles. And in addition, the computer should be "foolproof." Putting it simply, the school computer should be made in such a way

that it is immune to inroads of erasers and pencils or, for example, spilled ice cream.

This is probably why the ministries and agencies that ought to have developed a school computer in accordance with their service obligations and type of work have so far been unable to do so. The widely acclaimed "Agat" computer has turned out to be unsuitable for schools with regard to some parameters and features.

It should also be mentioned that it is not yet clear who is to produce the school computers, and how it is to be done. Today there is scarcely a single agency that is capable of taking on such a load as quickly producing a million computers for schools.

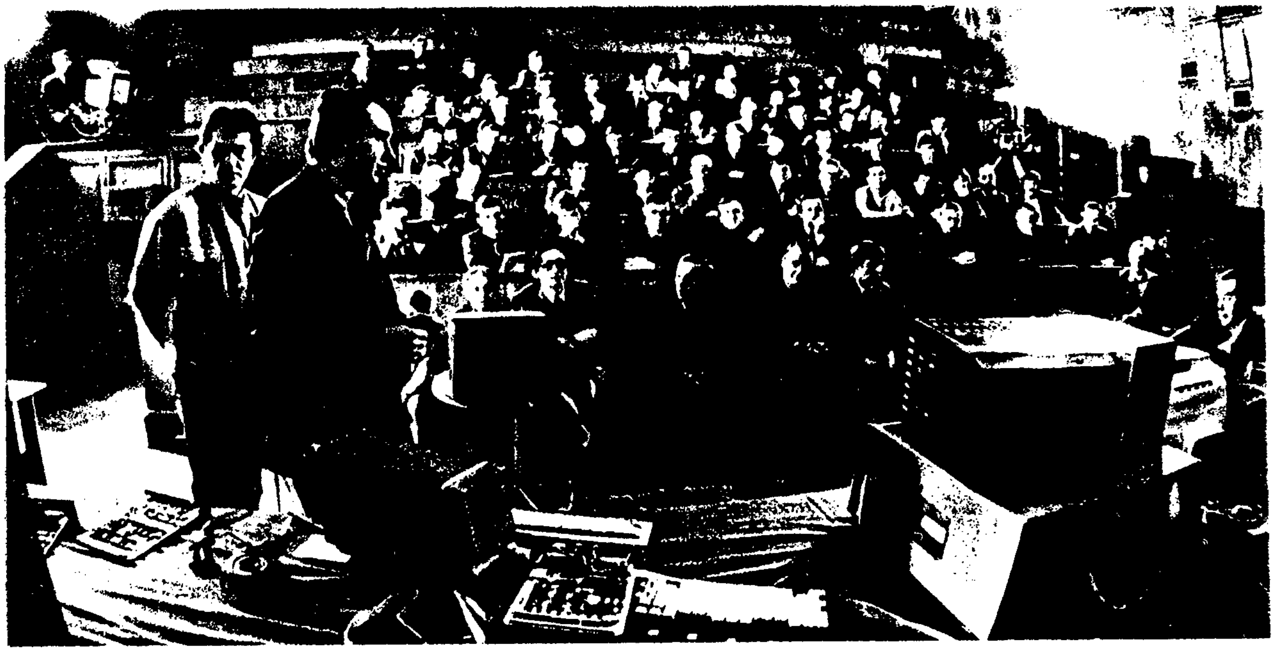
The solution to many problems has come from a completely unexpected quarter: from the users. At first timidly, and then with ever increasing confidence, designs have begun to appear for a personal computer for schools.

"Stone Soup"

A group of members of the chemistry department at Moscow State University led by Engineer V. Yu. Romanov was first to reach the intermediate finish line. They picked up a lot of experience, and by using the most inexpensive and plentiful components they made "stone soup." A new personal microcomputer was born. As it has turned out, this computer fits very nicely into the requirements of the Ministry of Education for school computers. And this is what helped: the group had a good understanding of the difficulties that students would encounter in working on the computer. In a matter of just a few months, V. Yu. Romanov and his group succeeded in producing an inexpensive microcomputer that is easy to work with. In addition, it is simple to make, technologically feasible, and does not use components that are in short supply. The machine has an original power supply with rather low voltage (24 volts), which is important in schools where high voltage is inadmissible. The developers of the machine realized that displays are expensive and hard to come by. Therefore, from the outset they designed the machine so that it could be interfaced with off-the-shelf television sets. These are inexpensive and take up little space on the school desk.

The first to try the machine was V. Yu. Romanov's daughter, Irisha, who is seven years old. The little girl was ecstatic: the machine was playing, the machine was teaching. In honor of the first "tryout," it was decided to name the machine "Irisha." And so it is named in the official documents.

From its inception, the "Irisha" was being readied for series manufacture. It is likely because of this that an enterprise of the USSR Ministry of the Radio Industry in cooperation with the Institute of Information Problems of the USSR Academy of Sciences undertook development of the technical and requirements specifications for the machine. Sets of production drawings and phototemplates have now been prepared. A trial production run is just around the bend.



The audience of the "Can Do" Television Show gets to know the capabilities of the "Irisha"

Economic Aspects

It might seem that with the development of the "Irisha" the problem has been solved. Besides, developments are proceeding on several other microcomputers both in the Ministry of the Electronics Industry and at the Physics Department of Moscow State University, as well as in some other academic institutions. And long series are being planned for all of them.

But if you think about it, it is not so easy to set up a complete computer classroom in a school. Schoolteachers who do not have the appropriate know-how or time are incapable of putting together the computer, monitor, keyboard, local net, teaching machine with disk drive -- everything that goes to make up the classroom. The Ministry of Education has therefore decided that it is necessary to deliver only complete sets of equipment to the schools.

They could be produced on the basis of cooperation among several enterprises. But there is still an obstacle on this reasonable and efficient road. The status quo is: only the one that outfits the classroom can set himself up as the "chief idler" in the quota for production of consumer goods. All other enterprises will write up their goods -- the individual components of the facility -- in the main quota. But it is meeting quotas for production of consumer goods by items for school microcomputers that interests the producers. And after all, is it right to set the quota for consumer goods for the outfitter alone? Probably some thought should have been given to the feasibility of including in the quota for consumer goods both the component items, the machine in its entirety, and the whole setup of the computer teaching classroom.

Then "Irisha" and other machines could be produced in many enterprises of the appropriate profiles. It is only in this way that we can think about items in the millions. And then it will not be merely the schools. After all, machines of this kind can be used to advantage in the instruction of students, and could be produced for over-the-counter sale. For example, the list price of the "Irisha" even now in small-series production is about 900 rubles, and in large-series production it will be appreciably lower.

Clearly, the personal computer has a great future. Why, even today every home has its television set, and many have a cassette recorder as well. This means that the display and the magnetic memory for the computers are already at home. The only thing that is left is to connect them to the machine with the keyboard. And in this way for a few hundred rubles you will have a personal computer at home. It will be your editor, personal secretary, a teacher for the children, a filing cabinet, an assistant in planning the family budget, in computations, work, education.

The program of school computerization in the West has got an apt name: "Children Can't Wait." In the People's Republic of Bulgaria, the "Pravets" computer is already being installed in kindergartens, and there are more than 9,000 microcomputers in the schools.

In the Soviet Union, interest in the personal computer is very high, plants are ready to produce them, the right chips are available, displays and keyboards have been developed. The main thing now is to organize mass production of these items that are crucial for home study, education and the national economy. Let's not forget that this is not just a matter of the latest fad, but a radical change in our way of working, learning and creating.

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COMPUTER USE IN GEORGIAN EDUCATION OUTLINED

Tbilisi MOLODEZH GRUZIY in Russian 8 May 86 p 3

[Article by G. Kibilov, junior associate, Institute for Computational Mathematics imeni N. Muskhelishvili, Georgian SSR Academy of Sciences: "Ready for Dialogue"]

[Text] Computers in schools, auditoria, and educational laboratories are an phenomenon to which we are accustomed. Today nobody is suprised about microprocessor technology in the educational process. Moreover, universal computer education, directed towards giving everybody computer literacy, has literally swamped the territorial organizations of the TsSU and computer centers.

This academic year at our institute young programmers studying at Tbilisi's professional-technical schools began exercises. Of course, we did not give ourselves the goal of turning fitters, potters or confectioners into processional programmers. The program, developed jointly with the Laboratory for the Scientific Basis of Management and Computer Education at the Republic Scientific-Methodological Center for Professional-Technical Education, gets young people acquainted with the basic principles of computer operation and the basics of algorithms. Frankly, many got so carried away by the exercises that they are thinking about a more serious dialogue with machines. By the end of this academic year 45 graduates from the PTU [Professional-technical academy] have already obtained operators' ratings. In addition, young people are studying, and quite successfully, the programming language BASIC, in the future they will switch to FORTRAN. In addition to a number of other problems, massive computerization, poses the one of a selection of a language for communicating with machines. Obviously, in the near future algorithms will be written in a single language and then, based upon this, programs will be compiled for a given machine. Students in our republic can communicate with the computer in Georgian, thanks to the "Shatili" control panel with a three language keyboard. Together with any type of ordinary TV set, it works as a terminal. Shatili was developed by associates from our institute at the Republic Academy of Sciences' Special Design Office for Scientific Instrument Building. The first group of machines will be tested at the scientific-educational complex which has been created at our institute to improve the skills of pedagogical and engineering personnel.

Computer "likbez" [elimination of illiteracy] is linked to a whole series of other problems. There are not enough skilled teachers, there is no single base where one can be retrained. It would not be a bad idea to organize such a school for teachers themselves. Even teachers of general educational subjects, specialists and industrial instructors have expressed a desire to participate in the development of training programs for computers. They have also worked satisfactorily with us on subject matter exercises and laboratory work. After all, the computer's has unlimited potentials in this area. We were very successful in our attempt to compile a problem book on special subjects, chemistry and physics.

The computer hardware boom which we are now experiencing is sharply increasing the demand for specialists to service computers. Restructuring has seriously begun at general educational schools and at schools in the Gosprofob [State Committee for Vocational and Technical education] system with the introduction of a new course -- informatika [information science]. The sooner young people become acquainted with computers, the more effectively many of them will later master operators' skills. Also, each student should be able to run a personal computer. After all, it won't be long before microprocessor sets and integrated circuits will be for sale. Now is the time to get ready for this. For the second time, a computer camp is to be held at one of the Sukhuma PTU. Not only will students here be able to work with computers, but information science instructors will find it useful.

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ESTONIAN CONFERENCE DISCUSSES EDUCATIONAL COMPUTERS

Tallinn SOVETSKAYA ESTONIYA in Russian 18 May 86

[Article by ETA [Estonian Telegraph Agency]: "Computers -- Pegagogues' Helpers"]

[Text] Quite recently at schools there was a dispute as to what colors chalkboards and chalk should be. This was not without basis. The fact is that medical specialists and psychologists were concerned about the health and normal conditions of teachers' work and students education. History repeats itself, only now the discussion is about computer screens, which are increasingly appearing in classrooms of secondary schools, training rooms at professional-technical academies and VUZ auditoria. Obviously, the color of the screens and the characters on them is of major importance for people, especially young people, working at them. Like chalkboards, the majority of sceeens are green and their brightness can be controlled. However, already people are not satisfied with two color screens. Therefore multicolor screens are appearing. On them, one can use a given color to depict the most important information and draw complicated figures. For example there is such a screen on the "Entel" computer, created for our republic's Gosprofobr by specialists at the Estonian SSR Ministry of Communications' Computer Center. However, screen color is only part of a broad set of problems in the computerization of secondary, specialized and higher educational institutions in the republic. They were the subject of a discussion at a scientific-technical conference organized by the Estonian Republic Board of Scientific-Technical Societies in Radio Engineering, Electronics and Communications imeni A. C. Popov and which was held in Tallinn on 16 May.

In the republic considerable experience has been acquired in the creation and use of computer hardware in the educational system. Fulfilling the decisions of the 27th CPSU Congress and the demands of school reform, the "Yuku" school microcomputer has been developed at the Special Design Office for Computer Technology at the ESSR Academy of Sciences' Cybernetics Institute, the "Tartu" personal computer was born at Tartu State University and the Tallinn Polytechnic Institute is training specialists in computer use, while at this latter place a faculty for improving skills in computer technology and information science is working successfully. However, specialists' efforts do not always find the necessary support from ministries and departments.

Participants at the conference became acquainted with the potentials of equipment on display there.

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NETWORKS

UkSSR MOTOR TRANSPORT OFFICIAL DISCUSSES COMPUTER USE

Moscow KRASNAYA ZVEZDA in Russian 29 Apr 86 p 4

[Interview with Lev Yakovlevich Zamanskiy, candidate of technical sciences, chief, Main Computer Center, UkSSR Ministry of Motor Transport by unidentified correspondent, date and place not specified]

> [Text] The Basic Directions for the Economic and Social Development of the USSR for 1986-1990 and for the Period up until the 2000 forsee: "...High growth rates in the use of modern highly productive electronic-computer machinery in all classes. A continuation of the creation and improvements in the efficieny of collective use computer centers, integrated data banks and networks for processing and transmitting information."

[Question] Lev Yakovlevich, what is a computer network and what progressive "charge" does it carry?

[Answer] I will begin with specific figures. In our republic there are hundreds of computer centers and most enterprises are equipped with computers. As a rule, at some time during the day, week or month each of them needs additional resources. We are talking about increases in speed, memory, peripheral equipment, service personnel. This is due to computer load fluctuations -- from low to peak. Under these conditions many managers try to increase computer capacity and create "their own" centers. This leads to difficulties in putting new capacity into operation and assuring the necessary conditions for their functioning.

Outlays for the maintenance and servicing of a single computer, for example, one in the YeS series, are hundreds of thousands of rubles annually. This shortage of resources will not disappear, and if it does this will be only be for a short duration. Why? Because, even in a single sector, one computer center may be overloaded while another free. Without hardware a manager cannot change the situaion by exchanging data between computers.

A second factor. The lack of sufficient automation in information colection creates delays. This reduces quality and the practical need for calculation results. The creation of computer networks, which improve management efficiency is a solution to the problems in collective use of "computer resources", the automation of data collection and processing and improvements in data reliability and timliness [sovremmenost]. It consists of computers

which are far apart from each other combined into a data transmission network and equipment used to hook up terminals to computers.

[Question] What are the basic directions in the creation of computer networks? What difficulties are encountered along the way?

[Answer] Networks are developed by a wide circle of organizations. Perhaps, even too broad. At present, there are networks based upon computers in the YeS and SM-4 lines, local area networks for large institutions. In our country, the leading place in the development of computer networks is held by the Latvian SSR Academy of Sciences' Institute for Electronics and Computer Technology, which is headed by E. Yakubaytis, member of the LaSSR Academy of Sciences. They have had good results. At the same time, the number of organizations independently initiating the design of networks, as they say "from zero", is steadily growing.

[Question] Does each of them invent their own "bicycle".

[Answer] Unfortunately, this is true. It would be more justified economically for them not to invent it, but to use experience and results already available.

[Question] Please explain about information-computer networks in your sector and results from their use.

[Answer] In accordance with the programm of the USSR GKNT [State Committee for Science and Technology] and the sector scientific-technical program in the UkSSR Ministry of Motor Transport a fragment of an information-computer network for the Kiev region has been created and put into operation. This fragment includes six computers located in Kiev and Zhitomir. Software for the information-computer center makes possible the collective use of all computers and the management of their loads.

Our information-computer center is now used to analyze fleet technical readiness, fuel consumption by unit and line norms and for operational accounts of freight and passenger transportation in the ministry.

[Question] Practice shows that not everything new can find its road. Are there difficulties in the introduction of computer networks?

[Answer] There are, even though the work done has been acknowledged. It has attracted the interest of the ASU [Automated management system] at the UkSSR Ministry of the Gas Industry, the republic Academy of Sciences and other organizations in the country.

At the same time, while pursuing departmental goals, some managers put up obstacles to signing contracts with organizations in other ministries and departments. They are not concerned about the economic effect which could be obtained for the country as a whole.

[Question] What could be said about the interaction of scientific and production potentials in the creation of computer networks?

[Answer] Methodological leadership in this work is exercised by A. Bakayev, correspondent member of the UkSSR Academy of Sciences and the chief designer of the ASU Avtotransport UkSSR. V. Vasilyev, doctor of technical sciences and prorektor at the Moscow Institute for Civil Aviation Engineers. V. Kulakovskiy, head of the main computer-information center helped in daily work and had a profound influence upon the work. The experience acquired helped in quite rapidly creating an information-computer network which took into account the specifics of the sector and which yielded positive results.

However, we must move forward. The main thing is to improve the efficiency collective use computer centers.

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FOREIGN TECHNOLOGY

MEGAMEMORY FOR COMPUTERS

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 7, 8-21 Apr 86 p 7

[Article by A. Prokofyev]

[Text] Manufacturing of elements of memory units is the largest sector of modern semiconductor industry. Today over a half of all manufactured integrated circuits (IC) are semiconductor memory IC. Besides their main application in computers, they are ever wider used in instrumentation, in various production devices and in consumer radioelectronics. We present the readers with a survey of modern trends in the field of memory devices, compiled from materials from specialized British and American magazines "Electronics", "Electronics Industry" and "Electronics Engineering".

Since the first integrated memory units appeared in the late sixties, the capacity of ZUPV (RAM units), i. e. the number of memory cells in a crystal, has been quadrupling approximately every three years: in 1970 the first 1 KB* IC appeared, followed by 4 KB IC in 1973, 16 KB IC in 1976, 64 KB IC in 1979 and 256 KB IC in 1984. Finally, last year 1 MB memory devices appeared.

If between 1970 and 1975 the main type of memory devices were 1 KB ZUPV, today they are 64 KB microcircuits. In the coming years, 256 KB memory devices will be produced on the largest scale.

The total storage capacity of world IC output doubles every year. If this pace will keep up in the future, and there are reasons to believe, that this will be the case, then in 10 years this figure will increase from 10^{13} to 10^{16} bit. This is equal to annual production of approximately 10 billion of 1 MB ZUPV, which is more than enough to, say, record all books, that have been written over the entire history of mankind!

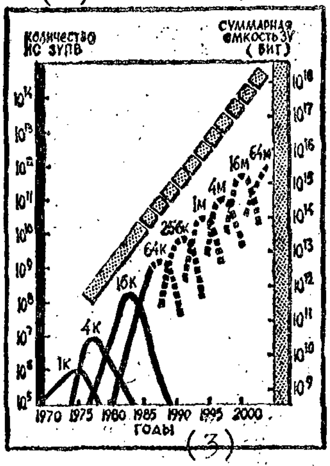
Up until recently, the vast majority of memory devices were manufactured, using the so called n-MOS technology. This technology has been optimized for manufacturing devices, that have high density and speed of response. However, as the degree of integration in n-MOS devices increases, a problem of power dissipation emerges.

IC, that are manufactured, using a different (CMOS) technology, even though

they are characterized by lower power consumption, until recently did not have sufficiently high speed of response. The work on improving the CMOS technology made it possible to make today IC with line width 1 m or less, and, at lower power consumption, attain practically the same speed of response, as that of n-MOS devices. It is this improved technology, that a Japanese company Hitachi uses for manufacturing 256 KB memory IC.

As has been mentioned above, last year the first 1 MB IC appeared. Some companies, first and foremost Japanese ones, have started series production thereof. Europeans are trying not to lag behind: Phillips and Siemens have combined their efforts within the "Megaproject" program with the goal to start in 1987 series production of 1 MB memory devices. A more remote goal of this cooperation is the development and manufacturing of 4 MB IC. To do this, one would need a technology, that can make it possible to form on a crystal elements, having size up to 0.7 μm.

(1) (2)



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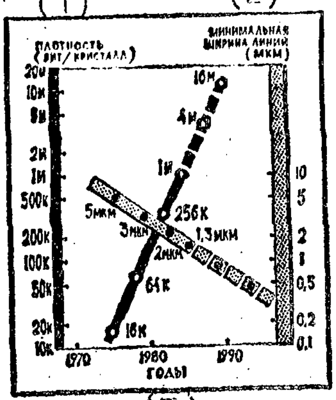

(3)

Figure 1 (left). Increase in Production of Memory Devices (Dynamic ZUPV). Data on various types of memory devices and increase in total capacity of memory devices, produced annually, are shown separately. Without getting into principal differences between dynamic and static ZUPV, we shall note, that, given the same manufacturing technology, the capacity of dynamic memory devices is higher, than that of static ones, by approximately a factor of four.

Key:
1. Number of ZUPV IC
2. Total ZU [memory units] capacity (bit)
3. Years

Figure 2 (right). Trends in Reducing Minimum Line Width (Minimum Technologically Possible Size of Elements). Transition in the nearest future to submicron technology will make it possible to make dynamic ZUPV with 4 MB and higher capacity.

Key:
1. Density (bit/crystal)
2. Minimum line width (μm)
3. Years

Figure 2 presents the relation between the information capacity of ZUPV and the line width, and their change trends in the future. If one extrapolates the curves, one can see, that in the year 2000 a 1 GB memory device will appear. In order to make such IC, one should be able to form elements with minimum dimensions of the order of 0.1 μm.

As the degree of integration increases, dimensions of individual elements become so small, that their operation begins to be affected to a large extent by ionizing radiation, the source of which could be cosmic rays or the natural radioactive background. It is well known, that, as the size of memory cells decreases, so does the capacitance of capacitors, that store information. Therefore a fly-by of even a single alpha-particle can upset the operation of a device. Modern technology makes it possible to efficiently solve this problem too: by decreasing the oxide thickness, it is possible to increase the capacitor capacitance above the threshold, at which such breakdowns occur.

Qualitative changes in integrated circuits manufacturing technology are also linked to mastering a new material for IC, gallium arsenide. So far, the wide use of gallium arsenide memory units is being held back by their rather high price. However, there is no doubt, that these difficulties will be overcome in the nearest future.

Advantages of the new material are well demonstrated by a development by an American company Rockwell: memory access time (parameter, that characterizes the speed of response) of this ZUPV does not exceed 10 ns. (For comparison, memory access time of similar silicon devices is considerably longer: from 400 to 35 ns). Theoretically, the speed of response of gallium arsenide memory devices can be increased even to hundreds picoseconds. Just due to this fact alone, even if the traditional architecture is preserved, computers' productivity can be increased by an order of magnitude.

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* In computer technology letter K denotes a number $K=2^{10}=1024$. thus 1 KB is not equal to 1 kilobit, but slightly higher. Similarly, letters M and G denote numbers $M=K^2=2^{20}$ and $G=K^3=2^{30}$, respectively. These symbols became standard in professional literature and are more and more often used in popular publications on computerized information processing.

- END -